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OIL SWITCHES.

The oil switch has made rapid strides in improvement during recent years. Indeed we are hardly past the era in which it was regarded as one of the least satisfactory portions of station equipment. It has been considered no matter for surprise if, in opening a line which has been short-circuited, the oil switch has paid the penalty for its service of almost complete destruction. In many cases it has been found under such circumstances that the switch contacts have been badly burned, the oil blown out of the tanks, the remaining oil so badly carbonized as to require renewal, and even the tank wrecked by explosion, but if the switch has performed its duty of opening the circuit, even at the cost of its life, we have been compelled to be satisfied with its performance.

It has been claimed that this inability of many oil switches to repeat their performance on short-circuit requires the installation not only of duplicate apparatus in the power station, but of duplicate transmission lines, where continuity of service is regarded as essential. While not all transmission lines have been erected with more than a single circuit, it has sometimes been claimed that this was merely a question of balancing capital cost against the requirements of continuity.

Today we may safely say that we have oil switches which are capable of opening short-circuits which have back of them almost unlimited power, without the necessity of wrecking the switch. The tests which were described in a paper by Mr. E. B. Merriam at the Chicago convention of the American Institute of Electrical Engineers demonstrate that reliable circuit-breakers exist. These tests were carried out upon a generator of 12,000 kilowatts at 9,000 volts. Under these conditions short-circuits were repeatedly opened without difficulty. Indeed the ultimate rupturing capacity of the switches was not reached. During some of the tests a small quantity of oil was expelled, but this amounted to not more than five per cent of the whole, and it was concluded that even this could be avoided by the proper use of baffle plates. Such plates can be applied to existing circuit-breakers with little change in the installation and at comparatively small expense. It was found that the oil was not appreciably heated, due to the intensely local action, which results, however, in the formation of some gas. Proper provision must be made for the elimination of this gas to avoid danger from

fire. It is also very necessary to provide a proper volume of oil and sufficient length of break. When the contacts are not parted with sufficient velocity there is likely to be greater disturbance and the rupturing capacity of the switch is decreased.

The concluding portion of an article by Mr. Stephen Q. Hayes describing modern forms of automatic circuit-breakers will be found in this issue. It can be said, probably without fear of contradiction, that in the design and construction of this apparatus America has taken the lead. The design of automatic circuit-breakers for protecting circuits carrying the largest available powers of today is no longer a bugbear and the central-station engineer can contemplate this portion of his equipment with the satisfaction that apparatus is available which is really able to perform the work required, and perform it as often as required.

The design of circuit-breakers has been largely a matter of empiricism, and it was not until some rather extended experience had been accumulated that minor imperfections could be eliminated and a satisfactory design realized. While there are still many possibilities of improvement, this apparatus has passed the stage of uncertainty.

ELECTRICITY AND PANICS.

While reason can hardly be said to hold sway in time of a panic, and though the crowd unthinkingly rushes out of a theater at a cry of "Fire" following the blowing out of a fuse, it does seem that a little wider and surer knowledge of electrical matters would decrease the loss of life from such causes. A recent and notable instance is that of the fire scare which occurred last Saturday at Cannonsburg, Pa.

In that case the cause of the panic was the blowing out of a fuse in the moving-picture booth. There was a loss of nearly thirty lives from the resultant panic.

Had even a fair proportion of those present been previously informed by reading or experience as to the nature of such an occurrence, the fire-proof booth construction required by the National Board of Fire Underwriters, and the absence of any danger, the panic would no doubt have been averted.

There seems to be a rather general lack of knowledge about electrical matters by those not directly connected with some branch of the industry. As an example may be cited the fact that a large percentage of the people using the street cars every day are almost without an idea of their mode of operation. It is for this reason that there is very often a near-panic when as a result of an overcrowded car, a circuit-breaker goes out.

There is no way absolutely to prevent the frenzied rush of people that follows a flash, but to acquaint them pretty thoroughly with the cause would at least lessen danger. As the number of those familiar with the harmlessness of such a flash and with electricity in general increase, there will be more faith in the safety of modern electrical appliances.

CENTRAL-STATION STEAM HEATING.

The most popular method of increasing the net revenues of the smaller central stations is by combining the functions of ice-making and steam heating with that of supplying electric light and power. These combinations have, in numerous cases, caused such an increase in net returns on the investment as to put such enterprise entirely out of the class of the ordinary small electric light and power plant.

In recent years and particularly during the season just drawing to a close many of the smaller plants located in towns where there is a demand for ice have entered into the manufacture of this "by-product" with the result that the so-called dull season has been one of increased profit.

With the approach of the heating season it would be well for the small central station to investigate the opportunities that lie in this field. The majority of small central stations operate non-condensing, which gives a by-product of exhaust steam containing eighty per cent or more of the heat units in the boiler steam. This steam can be utilized in the summer months for ice-making and in winter for steam heating, thus turning a waste into a dividend earner, and while enjoying the benefits of increased profits that accrue, the central-station company is strengthening its position as a public utility in the community which it serves.

While there is now no doubt as to the financial success of a central-station heating system in localities where such a system is justified, a few companies have found it a source of hardship. This is undoubtedly due to the fact that sufficient care was not given to the engineering features. The essentials of a successful heating system are proper design, good material, competent men to install the system and a rational scheme of charges. To those who are contemplating the installation of a central-station heating system there is no question of more importance than that of underground distributing mains. The constant loss, due to poor insulation and faulty construction of the transmission system, increases the cost of operation to such an extent that it often works a hardship on the operating company, turning a prospective dividend into a deficit. These features must be given the same thought as is given to an electrical transmission system.

One of the advantages of utilizing the exhaust steam, both for heating and ice-making, is that the company is in a position to furnish twenty-four hour electric service and can thus cultivate the various profitable day loads available in practically every locality. There is seldom a good excuse for letting power equipment, upon which fixed charges are accumulating night and day, remain idle during the major portion of the twenty-four hours. In the early days when electric lighting was the sole aim and purpose of a central station, such a condition of affairs had to be tolerated. Today in any town where there are manufacturing plants or other possible consumers of electric power, such a condition is merely an evidence of lack of enterprise.

SOME PHASES OF BREAKDOWN SERVICE.

Among the questions which tend to complicate the public relations of electric lighting and power companies, the supply of breakdown service to private plants easily takes a foremost place. There is no doubt that if many central-station managers followed their inclinations, their respective organizations would refuse to supply this form of service to isolated plants. Two good reasons may be cited, however, against such a policy, the first being that the refusal to admit a responsible consumer or possible taker of service to the system savors of discrimination; and in the second case the introduction of central-station service at times of emergency and its continuance during a more or less protracted period of failure in the isolated plant not seldom results in the adandonment of the latter and the securing of a desirable increase in business. More than once in progressive manufacturing cities has the temporary supply of electricity for mill service driven out the old methods of generating current in small and scattered stations owned and operated by private parties, just as in the mechanically driven textile mill or shoe factory the installation of a single electric motor in time of emergency has often led to the complete equipment of the establishment with this form of motive power.

The final question of importance in dealing with breakdown service is the price which may properly be charged for it. Obviously, local conditions will go far to indicate what is proper, but in general, it is justifiable on every count to establish a charge for breakdown service which will fully reimburse the company for its responsibilities in accepting this class of possible business. Operating companies whose rates are called in question upon one ground or another may well bear in mind some of the peculiarities of this special class of service, and be prepared to present the plain facts at the proper time. The operator of a private plant does not purchase current in the usual sense, but rather wishes the company's service placed at his disposal merely as a reserve. What is provided is not service in the common sense, but insurance to protect the isolated plant against breakdown or overload.

The service which the isolated-plant owner desires the company to render is the equivalent of a duplicate plant, duplicated from the coal pile and boilers through the engines and generators to an independent switchboard. Furthermore, he asks the company to supply the equivalent of such a plant under constant steam pressure, in at least slow operation, but ready to serve at an instant's notice, and for which special labor must be constantly provided. Instantaneous readiness-to-serve and reliability of service are not accomplished without large operating and maintenance costs as well as fixed charges. All of this is what the private plant operator desires to have available, but frequently without paying even the bare expense to which the company is subjected in maintaining the service. A leased telephone or telegraph line, assigned to the exclusive use of one customer, offers perhaps more clearly an excellent example of a parallel instance. Not a single message might be sent over the line for days at a time, yet, once established and in readiness for instantaneous service, the company erecting and maintaining it is subjected to a large expenditure in fixed charges, which bears practically no relation to the use to which the line may be subjected. Here the cost to the consumer should be based upon those necessary expenditures relating to interest, depreciation, and other fixed and maintenance charges proportional to the investment. Likewise, with the corresponding service of the central station, the price to the consumer must be fairly based upon the extent to which the company is required to hold itself at the immediate service of the isolated plant.

Another point seldom appreciated by owners of isolated plants is that the giving of breakdown connections as a matter of right to very large buildings might endanger the company's entire system by throwing on a very large installation without notice upon a portion of the system unprepared to handle such a heavy load, with consequent serious interruption of the general service. Again, if a company makes a contract to supply breakdown service it must immediately provide in service capacity and meters, in underground system and street mains, feeders and perhaps substations an amount of power which equals the amount called for in the contract, and this is entirely irrespective of the plant's breaking down, since the company agrees to deliver the service upon call. The usual question of diversity-factor does not enter so advantageously in breakdown service as in general supply, for the reason that isolated plants are liable to fail on the peak of the load, and in case of a blizzard, causing a shortage in the delivery of coal to the low-capacity bunkers of the private plants, the demand upon the central station for emergency service is certain to reach a heavy volume and call into operation a large proportion of the capacity invested in for breakdown services.

These considerations justify a substantial rate for breakdown connections, sometimes running as high as $30 per kilowatt connected per year, which in a typical case in a large Eastern city was equivalent to the proportion of the company's revenue consumed by fixed and maintenance charges on the plant required to furnish the emergency full-load connection. A liberal policy, however, may be followed in many cases by permitting the isolated-plant owner to consume electricity at the regular rates peculiar to his demand and utilization within the above price per kilowatt, and where this is done there is little reason for complaint on the part of the isolated plant.

Where charges are in vogue, based upon maximum demand, it is hardly just in such cases to consider merely the actual maximum demand. The potential demand of the customer may be quite as important in its bearing upon the central-station equipment, and the corresponding investment necessary.

American Institute News.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers, held on August 22, petitions were considered from members in Vancouver, B. C., and Lynn, Mass., for authority to form sections, and upon the recommendation of the Sections Committee the authority was granted.

The report of the committee recommending a change in the method of nominating officers of the Institute was considered, and in order to give it further consideration it was ordered to be brought up at the October or November meeting.

President Dunn announced the appointment of the Institute committees for the present administrative year. The following is a list of the chairmen of these committees: Executive, Gano Dunn; Finance, A. W. Berresford; Library, Samuel Sheldon; Meetings and Papers, H. W. Buck; Editing, W. I. Slichter; Board of Examiners, W. G. Carlton; Sections, Paul M. Lincoln; Code, George F. Sever; Law, C. A. Terry; Railway, Frank J. Sprague; Educational, A. S. Langsdorf; High-Tension Transmission, David B. Rushmore; Industrial Power, W. H. Powell; Telegraphy and Telephony, Bancroft Gherardi; Electric Lighting, P. Junkersfeld; Electrochemical, Albert F. Ganz; Power Station, S. D. Sprong; Indexing Transactions, George I. Rhodes; Public Policy, Henry G. Stott; Intermediate Grade of Membership, Percy H. Thomas; Historical Museum, T. C. Martin; Committee on Relations of Consulting Engineers, Francis Blossom; United States National Committee of International Electrotechnical Commission, C. O. Mailloux; Code of Ethics, George F. Sever.

The following representatives of the Institute were also appointed by President Dunn:—on Joint Committee on Engineering Education, Charles F. Scott and Samuel Sheldon; on American Year Book, Edward Caldwell; on Resuscitation Commission, A. E. Kennelly; on Electrical Committee of the National Fire Protection Association, George F. Sever.

The Board elected to serve upon the Edison Medal Committee for two years, Lewis B. Stillwell, H. H. Barnes, Jr., and S. D. Sprong. The Board also confirmed the appointment of Frank J. Sprague and Schuyler S. Wheeler as members of the Edison Medal Committee for terms of five years.

A resolution was adopted discontinuing the Committee on Conservation of Natural Resources and the President was authorized to appoint a committee of seven on Public Policy.

The President appointed Henry G. Stott, chairman, H. W. Buck, John J. Carty, John H. Finney, Charles W. Stone, Calvert Townley and James G. White.

The following resolutions were adopted:

Resolved: That it is the sense of the Board of Directors that it would be desirable to hold an International Electrical Congress during the Panama Exposition in San Francisco in 1915, and that such a Congress be initiated and conducted by the American Institute of Electrical Engineers under the authority of the International Electrotechnical Commission.

Resolved: That in furtherance of the project to hold an International Electrical Congress during the Panama Exposition at San Francisco in 1915, a committee on Congress organization be authorized, the members of same to be appointed by the President after receipt of such information from the International Electrotechnical Commission as would indicate a disposition on their part to authorize the American Institute of Electrical Engineers in the holding of such a Congress.

The President appointed Peter Junkersfeld and William B. Jackson as delegates to represent the Institute at the American Mining Congress.

The Board of Directors viewed favorably the project of an Institute trip to Panama in January or February, and the President appointed S. D. Sprong, chairman, A. W. Berresford, F. L. Hutchinson, P. Junkersfeld, H. A. Lardner, W. S. Rugg, D. B. Rushmore, Edward Schildhauer and A. M. Schoen as a committee to report in October.

J. L. Hutchinson was appointed acting secretary to fill the office until the end of the unexpired term of Ralph W. Pope, resigned.

It was decided that the proposed amendments to the Constitution providing for the appointment of the secretary by the Board of Directors should be submitted to the membership again next year.

President Dunn announced that during his absence in Europe, matters requiring the attention of the president should be referred to Vice-President H. W. Buck.

The Convention of the Pennsylvania Electric Association.

Advance registrations for the Pennsylvania Electric Association Convention, to be held at Conneaut Lake, Pa., have far exceeded the expectations of the most sanguine, assuring the fact that the attendance will be the greatest in the history of this Association.

The program, as outlined, contains a report of the Committee on Overhead Line Construction, including therewith a criticism of the National Committee's Report on the Preservation of Poles and Crossarms by Professor Jackson of State College, and additional information on "sages and spans" by William LeRoy Robertson; report of the Committee on Steam in connection with Central Station; report of the Committee on Rates; report of the Committee on Lamps; and also the following papers: "Motors," by A. M. Dudley; "Ornamental Street Lighting," by C. E. Stevens; "Service Connections," by P. H. Bartlett; "Central-Station Service Versus Isolated Plants," by T. E. Spence; "Electrical Appliances," by E. B. Greene.

The entertainment, as arranged under the able direction of George B. Muth and his committee, provides many unique features, the entire time, other than that devoted to the convention sessions, being provided for. Prizes will be awarded in various competitions.

International Congress on Testing Materials.

The sixth congress of the International Association for Testing Materials will be held at New York and Washington early in September, 1912. The president of the congress will be H. M. Howe, president of the American Society, and the secretary will be Edgar Marburg, University of Pennsylvania, Philadelphia. There will be three sections: A, dealing with metals; B, dealing with stone, cement, etc.; C, miscellaneous.

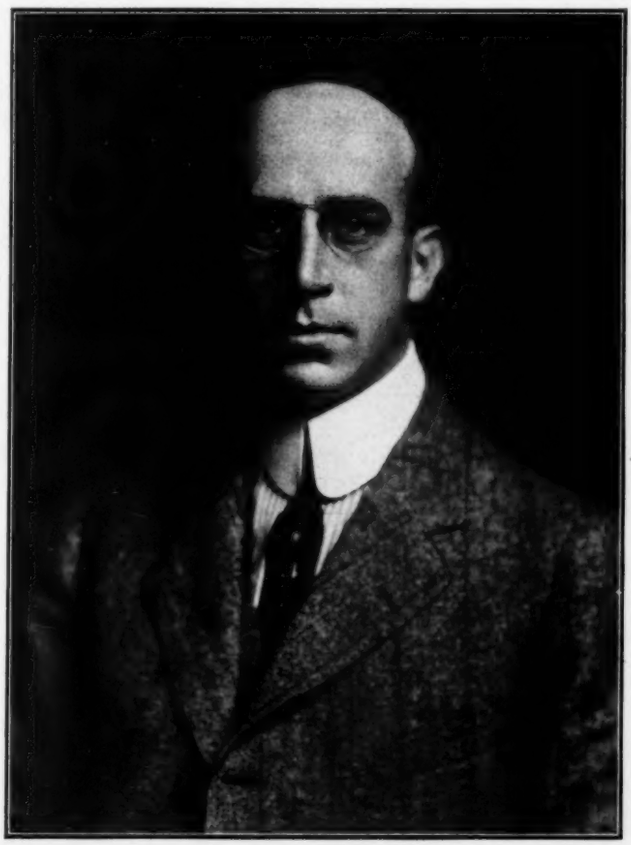
Indiana Coal Output.

Indiana's production of coal in 1910 was 18,389,815 short tons, valued at $20,813,659, a gain of 3,555,556 tons and $5,658,978 over the figures for 1909.

William N. Ryerson.

Among the electrical engineers who are guiding the destinies of the large power companies of the Northwest to success there is perhaps none who has earned a more prominent position than the subject of this sketch.

William Newton Ryerson was born in the city of New York in 1874. After passing through the lower schools he entered Columbia University and was one of the first to be graduated from the electrical engineering course of that institution, his diploma being received in 1896. The fifteen years which have intervened since that time have seen Mr. Ryerson exercising a variety of activities in the fields of telephone, railway and power-station engineering.



WILLIAM N. RYERSON,
General Manager, Great Northern Power Company.

After leaving college Mr. Ryerson spent a year in the testing and drafting departments of the Sprague Electric Elevator Company. From there he went to the drafting room of the Western Electric Company in New York City, and spent six months in designing power and telephone switchboards. He then became connected with the Metropolitan Street Railway Company in New York City, and spent three years in the construction and operating departments, his work being concerned with the installation of station wiring and switchboards and with the operation of the generating stations and substations. The following three and one-half years were spent with the Manhattan Railway Company and the Interborough Rapid Transit Company. A part of this time he acted as chief operator of the Seventy-fourth Street generating station in charge of the electrical work. For three years he was superintendent of substations for the Manhattan elevated and subway systems, having charge of the erection and operation of all substations.

In 1905 he went to Niagara Falls, Canada, as superintendent of the Ontario Power Company. Here he had charge not only of construction and operation of the generating station, but also was in charge of the local business and sale of power. While at Niagara Falls he also did considerable consulting engineering work for the various electrochemical industries located at that place. The great success which met his work at this place and the conspicuous ability displayed resulted in his being called on January 1, 1909, to the Great Northern Power Company at Duluth, Minn., to act as general manager in charge of the company's entire property. This position he still holds.

Mr. Ryerson is a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, Canadian Society of Civil Engineers, the Canadian Electrical Association and the National Electric Light Association. He served as president of the Canadian Electrical Association from 1908 to 1909, and was then re-elected for a second term. Upon the organization of the Power Transmission Section of the National Electric Light Association his eminence in this field was recognized by making him a member of the executive committee of that section. He has also served as a member of the Committee on High-Tension Transmission of the American Institute of Electrical Engineers.

Testing of Dirty Insulators.

The testing laboratory of the Swiss Electrotechnical Association has carried out a number of tests on porcelain insulators of different forms which had become blackened from locomotive smoke and soot during a considerable period of service. The insulation resistance showed a very appreciable lowering. The break-down voltage for a disruptive discharge was found to be reduced only ten per cent for dry insulators and fifteen per cent for those subjected to conditions of rain. As a result of these tests it is considered that no particular precautions are necessary against soot.

Program of Georgia Convention.

At the first annual convention of the Georgia Section, National Electric Light Association, to be held at Columbus, Ga., September 26 and 27, the following papers will be read: "Advantages of Co-operative Effort by Central Stations with Insurance Inspections," by A. M. Schoen, of the Southeastern Underwriters' Association, Atlanta; "Supply of Electric Energy to Textile Mills," by George K. Hutchins, of the Columbus Power Company; "Ice-Making as Associated with Central Stations," by Burdett Loomis, Jr., of the Ware County Light & Power Company; "Electric Heating Utensils," by L. L. Warfield, of the Westinghouse Electric & Manufacturing Company; "Low-Pressure Turbines," by E. H. Ginn, of the General Electric Company.

Among the entertainment features are a trip to the Goat Rock dam of the Columbus Power Company, a theater party, and a reception at the Muscogee Club.

Thomas W. Peters, of the Columbus Railroad Company, Columbus, Ga., is secretary of the Section.

Cheap Power in the Caucasus.

Two hydroelectric plants are to be built in the Caucasus by British capital. Power will be sold for not more than two cents per kilowatt-hour.

Electrolysis in Concrete.

A number of questions relating to electrolysis of steel in reinforced concrete were recently submitted by *Insurance Engineering* to various engineers, cement manufacturers and building constructors. While the answers are mostly expressions of opinion rather than the results of tests or special observations, the general consensus is interesting and valuable, and is given below in connection with the questions.

(1) What conditions of atmosphere or weather favor electrolysis more than others?

Moisture favors electrolysis, but the condition of the soil is more important than the dampness in the air. The character of business conducted in a building may affect moisture conditions more than the weather.

(2) Do you consider one type of reinforcement, such as the unit frame for floor girders, more susceptible to injury by stray electrical currents than another type?

Unit-frame type of construction is to be preferred. Where contracts between adjacent members are poorest, liability to electrolysis is greatest. Hence an all-steel building is not subjected to the same danger as reinforced concrete.

(3) Do you consider the danger from electrolysis greater where current is obtained from a public station than where it is furnished by a private plant on the premises?

Opinions contradictory.

(4) Do you consider the danger greater where public water is piped into the premises than where no such public connections exist?

Yes.

(5) Do you consider wooden pipes practicable or desirable for piping public water into a plant that is located near a public electric generating station for a trolley road?

Yes, but of small effect in well conducting soil.

(6) What safeguards would you recommend to insure timely signals or warnings of electrolytic action on the metallic reinforcement of concrete?

No suggestion other than readings of voltage between parts of structure or between one part and ground. During construction wires should be brought to the surface at suitable points for this purpose.

(7) What is the extreme danger from unarrested electrolytic action in reinforced-concrete buildings?

Disintegration of the concrete close to the steel destroys the adhesion. With the bond resistance gone, failure will result in members subject to tensile stresses. Foundations are especially liable to trouble.

(8) Do you recommend painting of all metallic reinforcement for concrete construction?

No. Painting gives a flexible film which prevents proper adhesion.

One correspondent mentions a successful means of preventing electrolysis by generating a surplus of hydrate on the metallic members.

A building in the British West Indies was constructed of concrete containing porous coral rock, porous sand and salt water. There ensued rusting of the reinforcement inside the concrete. The steel swelled and flaked the concrete in the same manner that is due to electrolytic action.

Two buildings which were torn down, one of them fourteen years old, showed no signs of electrolysis.

Pacific Electric Railway Employees Hold Outing.

The third annual outing of the employees of the mechanical department of the Pacific Electric Railway Company, Los Angeles, Cal., was held at Redondo Beach, August 23.

Twenty special cars were provided by the company to transport a throng of four thousand persons, including employees and their families. Officials of the system were present to encourage and further the occasion.

The program was devoted to sport and amusement; of the former thirty-four athletic events were arranged by the picnic committee, in charge of Chairman J. A. McGraw, each being accompanied by four or five prizes for successful contestants. These ranged from articles costing a trifle to those worth $100. A ball game was played in the morning between teams from the mechanical and general-office forces, the latter winning by a very small margin.

Bathing, dancing and other amusements were participated in by many of those present.

Large Italian Power Project.

A new hydroelectric project has been undertaken in the Piedmont district of Italy. The plant will be located at Orcotal and will have a capacity of 40,000 horsepower.

Railway Situation in Toledo.

City Solicitor Cornell Schreiber, of Toledo, O., has been instructed to file a suit against the Toledo Railways & Light Company, asking that it be ousted from all streets where franchises have expired. Recently an ordinance was passed by the City Council giving the company the alternative of paying $250 per day for the use of the streets, and about $70,000 constituting back payments for the time since the expiration of franchises last November, or vacate the streets. The company was given until August 25 to determine its action. The money was not forthcoming and action was taken by the city.

Negotiations have been under way for many months looking to a renewal of expired franchises, and a possible extension of others which will soon come to an end. A deadlock in the negotiations came when the subject of fixing a valuation of the company property for the purpose of determining the rate of fare was reached. The negotiators could not agree upon a tribunal to decide these valuations, and proceedings were brought to an abrupt end.

The administration is absolutely bound by its campaign pledges to stand for three-cent fares and universal transfers, while on the other hand the company maintains that such a rate of fare is an impossibility under existing conditions. An ordinance providing for a renewal of franchises at a three-cent fare was recently introduced into council where it is now awaiting action. In the meantime street-paving improvements aggregating many thousands of dollars are being held up, on streets where expired franchises are in question.

The Government Suits.

It is reported from Washington that the Department of Justice has practically finished negotiations with attorneys for the electrical interests which will result in an agreed decree embodying all the Government asks in its suit for dissolution of the alleged combination. As soon as the decree receives the formal approval of Attorney-General Wickersham it will be presented to the United States court at Cleveland. Although the so-called trust was said to consist of sixteen pools and the Government sued only one, it has received evidence that the other fifteen have been dissolved.

An Important British Electricity Supply System.

The New Power Station at Dunston, England.

Three years ago the Newcastle-upon-Tyne Electric Supply Company, finding it necessary to considerably extend its plant and not having a great deal of land available for extension purposes at Carville, started work on a new generating station eight miles from Carville, on the River Tyne. This station is situated at Dunston, on a site of thirty and one-half acres.

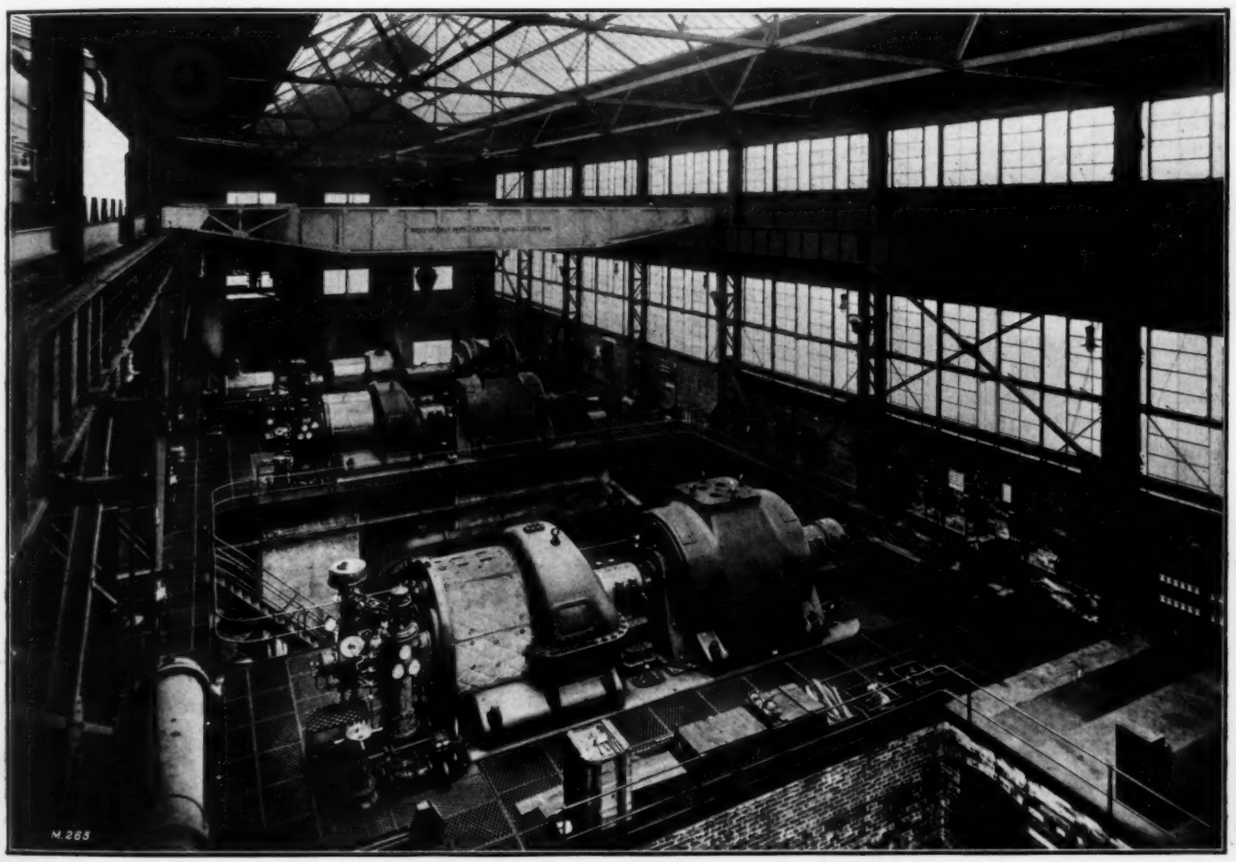
The North East Coast power system now covers an area of over 1,000 square miles, extending from Blyth in the north to Guisboro, in the south, and westward from the coast to Consett and Bankfoot. It at present supplies some 150,000 horsepower for railways, tramways, collieries, shipyards, lighting, heating, cooking and electrochemical work, and it was to meet the annual increase of business amounting to 20,000 horsepower, that the Dunston station was built.

In addition to the new site giving plenty of available land both for the extension of the plant and for the location of new industries that might be attracted, it has also practically doubled the cable capacity of the very heavy cable network which exists on both sides of the Tyne. Dunston is situated near one end of the Tyne network, and Carville is toward the other end. The cables which run on each side of the Tyne are connected together at Carville by means of a tunnel under the river, and above this point over the two bridges of the North Eastern Railway. The existence of the Dunston station thus improves the position of the company from the distribution point of view.

The site has a frontage on the Tyne of 900 feet. Coal can be obtained easily from either the Durham or the Northumberland coal-fields. Condensing water is obtained from the Tyne by suction pipes from each generating unit taken direct to the river.

The station generates three-phase current at a periodicity of forty cycles and a normal voltage of 5,750. The steam pressure is 200 pounds per square inch and the steam is superheated, the total temperature being 570 degrees Fahrenheit. The layout is such as to eventually accommodate six generating units, each of 8,000-kilowatts continuous and 10,000-kilowatts maximum capacity or a total capacity of nearly 50,000 kilowatts. So far the engine room has been built for four units, and three are already in position.

There will be a boiler house for every two units. Eight boilers will be installed in each boiler house, making twenty-four in all. The boiler-house arrangement provides for a very roomy basement in which the ashes are handled, ash bunkers being provided under each boiler to store the accumulation of ashes from fourteen hours' operation at full load. At ordinary load each bunker will only require clearing once in twenty-four hours.



MAIN GENERATING ROOM, DUNSTON POWER STATION.

Trucks in which the ashes are removed are elevated by electric lifts, and the ashes are dumped into a large overhead ash bunker, one being provided for each boiler house.

The boilers are grouped in pairs, each boiler having its own superheater and economizer. The gases from each pair of boilers are dealt with by one motor-driven fan and one chimney, both placed immediately over the corresponding boilers. Between the economizers which are arranged overhead in pairs and down the center of the boiler house there are placed large coal bunkers to hold a week's coal supply. The boiler installation is designed so that when working at maximum economy the chimney gases are reduced to below 300 degrees Fahrenheit. The boilers are of Babcock & Wilcox water-tube marine type, having 6,725 square feet of heating surface. Each boiler is equipped with chain-grate stokers. When necessary the coal is passed through a coal crusher and it is then transported by a conveyor which will handle forty tons per hour, to a storage bin at the end of the boiler house where there is room for a three weeks' supply. Under the storage bin is a tunnel in which there are filling hoppers which again feed into the same conveyor, so that one conveyor either delivers the coal direct to the boiler-house bunkers or delivers it to the storage bin. The coal from the boiler-house bunkers is led by vertical gravity shoots direct into the boiler receiving hoppers and from thence to the chain-grate stokers. Each boiler has its economizer which is situated with the fans and fan motors at the top of the building. The boiler house is arranged with a series of galleries at different heights for water tenders, and in order to obtain access to the economizers, fan motors, etc.

The buildings are all steel-frame structures, very little brick work being used. All the main switchgear is arranged in a separate building 150 yards away from the engine house; this allows of the engine room being light and convenient, and makes possible a switch-house from which cables can be taken in and out on any side, facilitating the work of future extensions.

There is one main steam pipe, feed-water pipe, hot-well pump, and ash-conveying plant for each set of four boilers. Each turbo-alternator unit has its own set of engine-room and boiler-house auxiliaries supplied with power from an independent "unit" transformer.

There will eventually be three circulating water sumps (one for every two units) situated in the engine room midway between each pair of turbines; their depth is thirty feet below engine-room floor level. In each circulating-water sump there are two main centrifugal pumps, one for each generating unit, and situated at such a depth that they are submerged at all states of the tide. The pumps have vertical spindles and are driven by electric motors installed on the engine-room floor. The suction of each circulating pump communicates by a twenty-four-inch cast-iron pipe direct with the intake sumps at the river. There are suitable gratings to the sumps to prevent foreign matter getting into the circulating system, and each condenser has self-cleaning screens.

Instead of a tile or brick flooring around the turbines, as in Continental practice, the Dunston station provides for access to the turbines themselves by means of an open-work cast-iron floor plate. Behind the turbines on the same level and between them and the boiler house, are the feed pumps, hot wells, water meters, etc., these being arranged to be operated by the turbine operators. Beneath the pump gallery are various smaller pumps, etc.; on the same basement level are the condensers and electrically driven air pumps. The feed-pump exhausts can be taken either to the hot-well tanks or to the water softener, or direct to atmosphere.

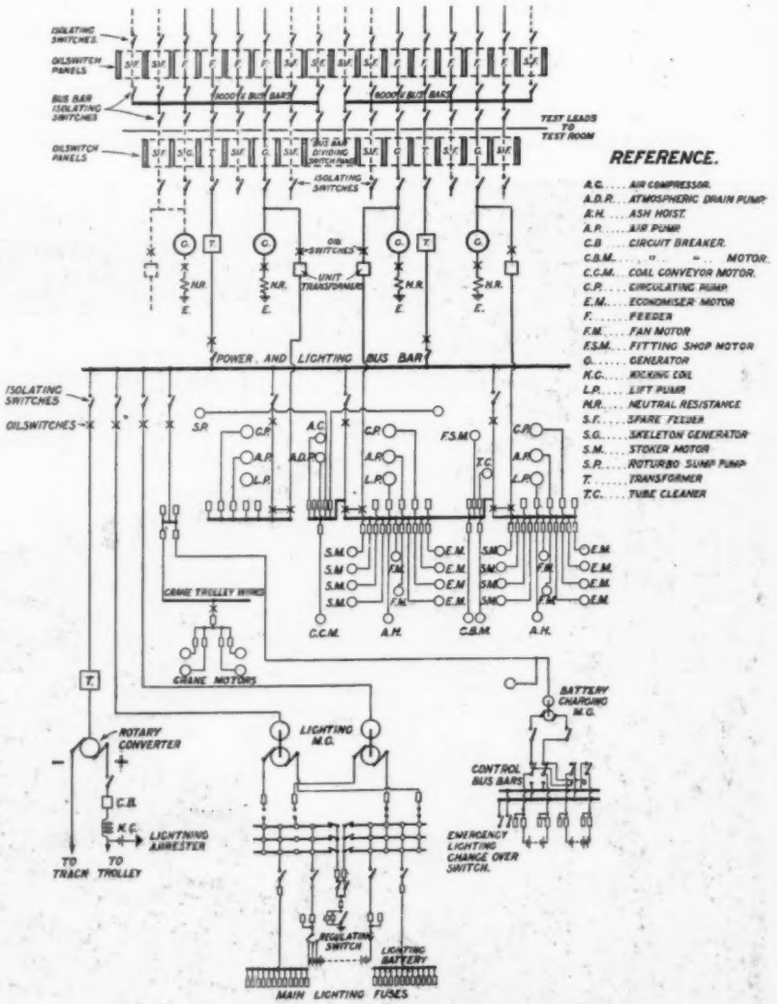
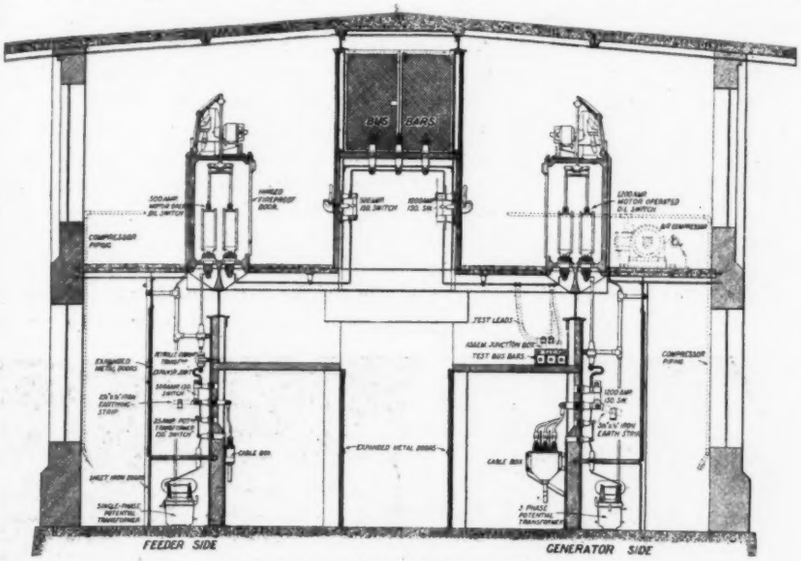


DIAGRAM OF MAIN CONNECTIONS, DUNSTON STATION.

Of the main generating sets at present installed two are of the Allgemeine Elektricitäts Gesellschaft impluse-type turbines running at 1,200 revolutions per minute and driving 8,000-kilovolt-ampere alternators; the third is of the two-cylinder Brown-Boveri-Parsons type, driving a 7,000-kilovolt-ampere, Brown-Boveri alternator. The exciters are arranged on the ends of the alternator shafts. For ventilating the alternators

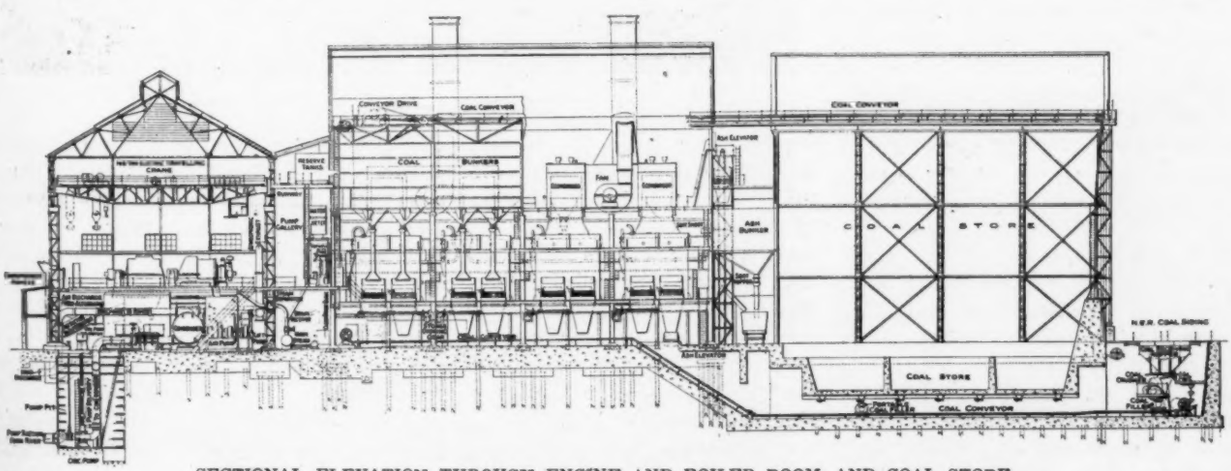
special measures have been taken. While at Carville and elsewhere it is the practice to draw in the air from outside the building by special fans, so as to insure at all times a supply of cold air, at Dunston the fans are placed on the alternators themselves, but the air is drawn in through special filters, there being a separate duct and filter for each alternator. The outlets from the Dunston alternators are so arranged that the hot air can either be discharged direct outside the building or into the engine room, thus making it possible to control the temperature of the engine room at will.



SECTION THROUGH SWITCH HOUSE.

For power purposes in the station, three-phase 440-volt current is used. The motor auxiliaries belonging to each unit are normally fed from a separate 500-kilowatt step-down transformer installed in a fire proof compartment opposite each alternator. The primary of the transformer is directly connected through switches, to the main terminals of its own alternator so that the auxiliaries are supplied even if the main alternator switch is off. In addition to these separate low-tension three-phase circuits, for each unit there is a common low-tension three-phase system fed from the main high-tension busbars in the switch house through two 500-kilowatt three-phase step-down transformers, which supply a set of low-tension busbars placed in an inclosed gallery in the engine room. A supply can be given for starting up from these busbars to the auxiliaries belonging to each unit. Normally these busbars only supply the motor generators, rotary converter and isolated motors, such as crane motors, throughout the works. The fields of the exciters can be separately excited. Two fifty-kilowatt motor-generator sets provide direct current at 100 volts for lighting the station and charging the station battery, which is kept in circuit to insure an absolutely independent supply of lighting. A small motor-generator set is also used for charging two control batteries used for operating the high-tension switchgear. There are three batteries, the large one giving 1,000 amperes for one hour for lighting, two others giving 100 amperes each. A 250-kilowatt rotary convertor supplies the power for the electric locomotives.

The switchgear arrangements call for special attention, and the engineers claim them a distinct advance over previous practice. At the other big station owned by the Newcastle Company (Carville) there is the usual elaborate switchboard, while at Dunston, the engine-room contains practically no high-tension switchgear or electrical instruments at all. With the exception of certain unobtrusive high-tension panels of ironclad type controlling the "unit" transformers which supply the auxiliaries of each unit, and an indicating wall ammeter for each generator, the high-tension gear and instruments are installed in the already mentioned separate switch house. There is, however, in the engine room near each generator, a set of emergency gear for tripping the main high-tension switches in the switch house, with which is interlocked a field switch; but apart from these and the direct-current gear for motor generators, there are practically no electrical connections or cables visible at all, proper underground ducts, etc., for the whole of the main cable wiring having been provided for in advance.



SECTIONAL ELEVATION THROUGH ENGINE AND BOILER ROOM AND COAL STORE.

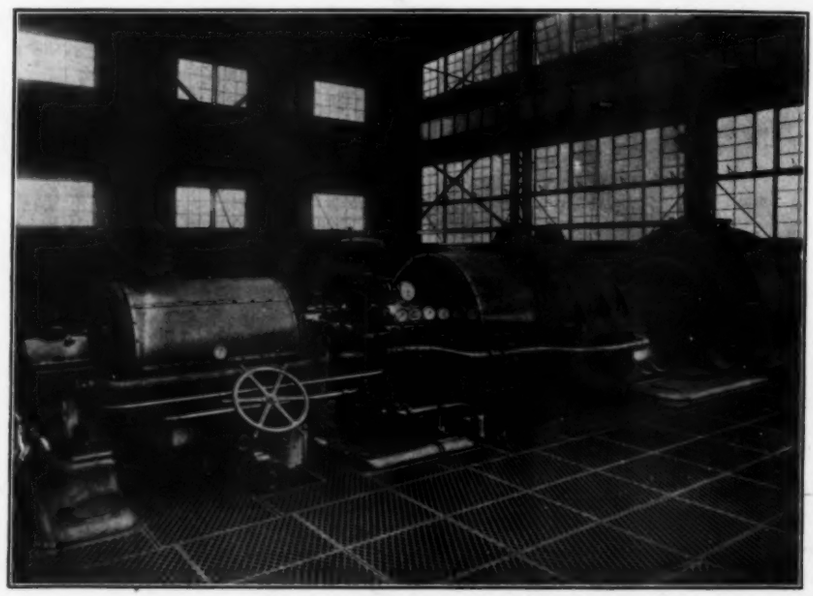
The switch house, which is a building

135 feet long by 33 feet broad by 32 feet high, has two floors and is divided into two divisions. On the first floor, front, are the offices, lavatories, etc., for the control-room engineer, the control room itself containing the operating boards, being also on the first floor. The back part of the building, shut off by iron doors, is devoted to the switchgear itself, the main oil-break switches and busbars being on the upper floor, the isolating switches, current and potential transformers, etc., being in brick cells on the lower floor. The bare high-tension connections between main switches and busbars, etc., are on the underside of the roof of the lower room, in full view and accessible from the lower room with ladders but quite out of reach of accidental contact. The control room measures forty feet by thirty feet, and is well lighted, being equipped with a glass roof. It is mainly occupied by the semi-circular operating switchboard (for feeders) and the smaller board for generators. The operating board of black slate is divided into sections, the generator and transformer panels and busbar switches being placed separately from those controlling the feeders. The various operating panels are arranged so that the particular feeder controlled by any individual operating panel can be changed at any time. The control gear is operated by means of direct-current from the two small batteries.

There are, on each generator panel, a main ammeter and voltmeter, power- factor indicator, indicating wattmeter, field ammeter, integrating wattmeter, etc., also a switch for controlling the governor of the turbine and a rheostat hand-wheel in front as well as a telegraph to each generator. At each end of the generator board is a synchronizing panel with rotary synchronoscope. Each feeder panel on the feeder-control board has a separate set of instruments and a set of synchronizing and volt meter plugs for synchromizing any other generating station with the machines at Dunston. The feeders are protected with Merz-Price balanced protective gear. Both the feeder and generator panels have throw-over control switches arranged to make or break the main oil-break switch immediately contact is made. The position of the main oil-break switch is indicated by the lighting of a red or blue lamp, and the operation last performed is automatically indicated by the position of a small colored pin on the switch handle.

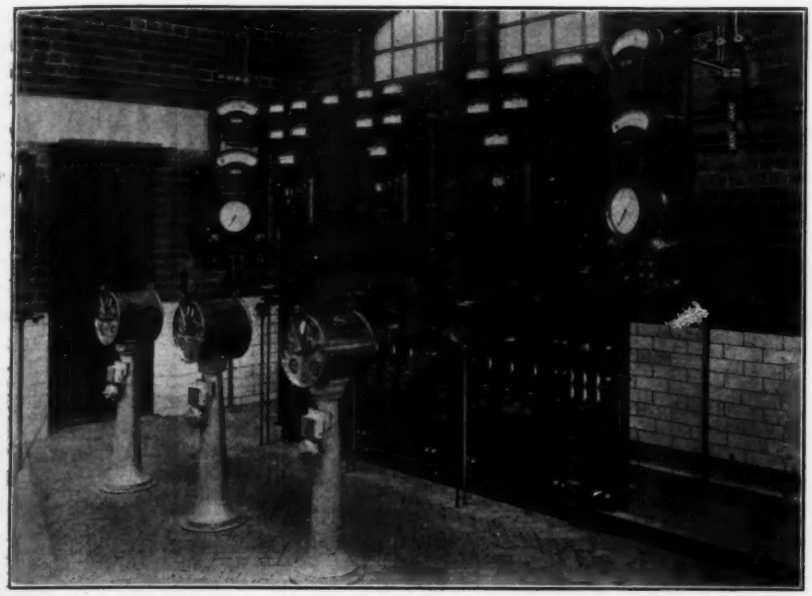
The switch room has two floors, access being obtained to the upper one through an iron door leading from the control room and to the lower floor from the passage-way under the control room. The busbars and main oil-break switches are on the upper floor, the connections and isolating switches and current and potential transformers on the lower floor. The cables from separate generators or feeders are brought up through the ground into separate brickwork cells opening on to the central passageway in the lower chamber. From the three-way dividing boxes the three single connections pass through the wall to a brickwork cell on the other side, which is accessible by means of expanded-metal doors from the outer passages running the length of the lower chamber. Each of these cells contains three single-pole main isolating switches as well as isolating switches for the potential transformers placed on the ground below in a small brick cell, protected by sheet-iron doors. From the main isolating switches the three connections are taken up through expansion joints and current transformers to the bottom connection of the main oil-break switch in the ceiling, the switch itself being placed in the upper floor. In the upper room three moulded stone slabs run parallel to each other along the room, being continuous except for a division of some six feet or seven feet in the middle. The main 6,000-volt busbars rest upon insulators on the central table, which is five feet high, and are protected by expanded metal screens running up to the ceiling for the whole length, thus forming a cage in which the busbars are placed and are visible for their whole length, but are inaccessible until the screens are removed. The busbars are divided in the middle of the room by means of a main oil-break switch capable of carrying 20,000 kilowatts continuously, and opening under any load likely to be met with. On the two side slabs are fixed the oil-break switches, the left side of the room being entirely devoted to feeders.

The main oil-break switches are of the British Thomson-Houston Company's type. Each of the three cylinders containing the actual switch is in a separate cell, and in front of each cell is a hinged "uacolite" door to allow the escape of hot air, etc., when necessary. The motors operating the switches are arranged to wind up a spring immediately the switch has operated, so that the make or break is instantaneous on the closing of the control switch on the control board. Each oil-break switch can be made "dead" by means of isolating switches, there being one set for isolating it from the busbar and one to isolate it from the incoming cables. The busbar isolating switches are situated under the busbar slab in the ceiling of the lower chamber, but the handles operating them are in the upper chamber on the side of the busbar table, each one being exactly opposite its own main switch. The isolating switches for cutting off the main switch from the cables are situated



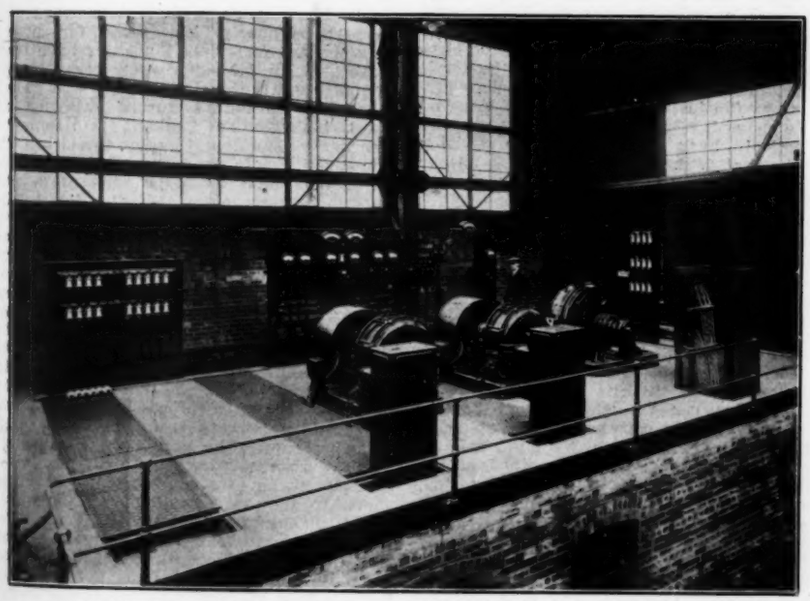
7,000-KILOWATT TURBO-ALTERNATOR.

in the lower chamber. All the high-tension panels are provided with balanced protective gear. There is an air compressor and set of compressor piping throughout the switch-house for cleaning purposes.



GENERATOR CONTROL BOARD AND TELEGRAPH SETS.

In the engine room there is a neutral isolating switch for each generator and a set of emergency tripping gear, by which, in case of urgent necessity, the main generator oil-break switch in the engine house can be operated from the engine room. On the wall of the engine room opposite each generator there is an indicating ammeter, and each generator also has its own "unit" transforming set in the transformer annex. The leads for these transformers do not pass through the switch house but are taken directly from the generator terminals through ironclad switchgear of the Reyrolle type which is placed in chambers on the northern side of the generating room.



MOTOR-GENERATOR SETS AND DIRECT-CURRENT SWITCHBOARDS.

Utilization of Canada's Peat Bogs.

It has been estimated that the known peat bogs of Canada, which are probably only a small fraction of the total, cover an area of approximately 36,000 square miles, from which about 28,000,000,000 tons of air-dried peat could be produced. This would be equal in fuel value to some 14,000,000,000 tons of coal.

Believing that the most effective method of awakening public interest in the utilization of Canada's peat resources would be the establishment of a plant on a commercial scale, equipped with the machinery and appliances that have been successfully used in European practice, a peat bog of 300 acres, with an average depth of eight feet, was acquired by the Canadian Government at Alfred, near Caledonia Springs, Prescott County, Ontario. About five miles of ditches have been dug and a storage shed to hold 300 tons of air-dried peat, a blacksmith's shop and an office have been built.

It is estimated that the expense of erecting a peat plant capable of producing 30 tons of air-dried peat daily should not exceed $7,000; and since workable peat bogs are scattered throughout the farming regions of Ontario and Quebec, the most economical plan for utilizing this fuel would be the erection of a number of plants at convenient points, to be operated in the interests of the neighboring communities.

During the summer of 1909 a substantial brick building suitable for equipment with modern fuel-testing machinery and appliances was built at Ottawa, also a storage shed holding 150 tons of peat fuel. The present installation consists of a peat-gas producer,with the necessary cooler, scrubber, tar extractor, etc.; sixty-horsepower, four-cycle gas engine; Westinghouse fifty-kilowatt dynamo, direct-connected; and a sixty-kilowatt resistance coil to absorb the load when making tests; also a switchboard, with the necessary measuring and testing instruments.

The main building is divided into two parts, one of which is occupied by the peat-gas producer and its auxiliary apparatus. The other half is divided by a partition wall into two compartments, one being occupied by the gas engine and dynamo, the other reserved for an ore-dressing laboratory, to be equipped with a forty-horsepower motor and concentrating machinery, the power for which is to be supplied by electric energy generated in the adjoining peat-gas plant. The gas-generating room has been made large enough to accommodate other types of gas producers, especially designed for using bituminous coal or lignite as fuel.

INDIANA ELECTRIC LIGHT ASSOCIATION.

THIRD ANNUAL CONVENTION, SOUTH BEND, IND., AUGUST 23 AND 24.

Despite unfavorable weather and the distraction of quite a few of its members at another simultaneous convention in Ohio, the Indiana Electric Light Association held its as yet most successful convention at South Bend on August 23 and 24. The Association headquarters were at the Oliver Hotel, where about 125 central-station men and manufacturers' representatives assembled for the third annual meeting.

The first session opened Wednesday morning at the call of President F. A. Bryan, who expressed his pleasure as a citizen of South Bend in welcoming the Association to his city. The first important item of business to come before the convention was the reading of the annual presidential address.

PRESIDENT'S ADDRESS.

After calling attention to the value of associations of central-station men, President Bryan referred to the change in the topics that had been considered by such organizations. Formerly technical matters were to the fore. Now new-business methods and other questions of management and policy receive the most consideration. It was rightly so. The unfriendly public feeling against public-utility interests still prevailing in many quarters had slight foundation in the mistaken policies of a relatively few old corporations, but now rests chiefly on the common ignorance of the nature and the mutual interest of all public-service business. As an outgrowth of this feeling, however, has come some form or other of governmental regulation. While all interference with private business may seem disagreeable, it need not necessarily be so if it does not go too far. In fact equitable regulation of public utilities may even be desirable, if it is a bulwark between the clamor of the politician or demagogue and the public-service corporation. Inasmuch as the latter is now bound to submit to some regulation, it is advisable that it endeavor to have that regulation be reasonable and fair. Public-service commissions have been established in many states and in some instances have done excellent work and in others not so creditable. The draft of a public-service bill should be carefully watched in Indiana. Although the central-station industry has advanced by leaps and bounds, Mr. Bryan concluded that it was not a vain hope of the future to expect a practical universal extension of electric service to all commercial and industrial establishments and to all residences, so that we may yet see the ideal smokeless and spotless cities.

The annual report of Secretary-Treasurer J. V. Zartman, of Indianapolis, was then presented. The membership of the Association consisted of 61 active member companies and 25 associate members. About 21 delinquent members were ordered to be dropped. Still including these gave a total of 82 central stations more or less closely connected with the organization, although this is only about three years old. The financial condition of the Association is excellent and its balance on hand has been increased during the year.

After some other routine business the first paper on the program was presented by John Hornung, of the W. H. Schott Company, Chicago. It was entitled "Heating in Connection with Central-Station Work."

CENTRAL-STATION HEATING.

The problem of heating from a central station as an auxiliary to electric light and power service has long been under investigation by public-utility operators with varying results. Some have found it an excellent source of revenue, others an endless source of trouble. The latter was almost invariably the rule with the earliest installations. Now that a great deal more is known about how to install a proper piping system and how to handle the equipment, the chief causes of loss and trouble have been eliminated. Many of the large operating companies are now finding heating to be a very profitable business and with well designed, modern equipments it is invariably so. It is now organized on a permanent basis and every feature of the equipment and of the operating methods is entirely beyond the experimental stage. Probably the greatest advance has been in the installation of well protected heating mains. To get a fair return on this part of the investment, it is desirable that the system be compact, that is, supply as large a heating load per block as possible; this also reduces the percentage of loss in the mains. Every central-station manager should make a complete analysis of his plant on the heat-unit basis, to see exactly how and in what proportions the initial heat energy of the coal is dispersed. Mr. Hornung showed very effectively by a diagram such a division of the heat of the coal into available energy at the switchboard and into losses in the converting units and auxiliaries. Much further improvement in efficiency of the main units is not to be expected. By far the greatest heat loss is in the exhaust steam, if this is discharged directly into the atmosphere. Improvement in the process is possible by utilizing this exhaust either in the condenser or in a heating system. The author then discussed the conditions under which the latter gives the best results. One of these is to maintain a fair balance between the electric and heating loads so that not very much live steam is required for the latter nor too much exhaust steam goes to waste. The method of tapping the intermediate pressure of a compound engine or turbine was described, as well as the operation of the various auxiliaries to a heating system.

President Bryan opened the discussion of the paper. He said central heating has been regarded as a doubtful proposition by many in the past, but now a steadily increasing number of operators are finding that with modern apparatus and methods it is a very profitable undertaking. It is not unreasonable to hope, therefore, that in the not distant future many cities will be entirely heated from central stations.

R. A. MacGregor, of Connersville, Ind., spoke of some of the difficulties he had had with an auxiliary heating plant, which gave rather unsatisfactory results. He also had considerable trouble with piston pumps and regarded them as uneconomical, even the statements of salesmen bearing this out. He has become convinced of the great value of flue-gas analysis as a means of changing a "hot-air" factory into a plant of high coal economy. He had also found it expedient to get more electric load so as to secure a more balanced relation between the electric and heating loads.

Mr. Kyle advised him to use electrically-driven centrifugal pumps, both to solve his pump troubles and to secure more electric load. Mr. MacGregor replied that he is putting in electric pumps and hopes to get better results.

Mr. Hornung discussed the need for close packing of piston pumps and the advisability of using steam or electric pumps, this varying with conditions. He also explained more fully the reasons for securing a balanced load.

A paper on "Power" was then read by R. A. MacGregor, manager of the Connersville Light, Heat & Power Company.

POWER RATES.

Mr. MacGregor's paper was a strong plea against ruinously low rates for power customers. Extremely low rates have been advocated for all motor users regardless of the size of the installation or its load-factor; some manufacturers' salesmen almost insist on a two-cent rate for even fan motors and dental motors to aid in their introduction. In many small communities in Indiana such low power rates prevail, although they represent a distinct loss to the plant and are evidently unfair to the rest of the consumers, who must be charged excess rates to make up for the deficiency. Moreover they are demoralizing to other towns, because when they hear of such low rates they expect similar ones and consider themselves robbed if they cannot obtain them. It is difficult to convince people of the difference in conditions between different communities. The author was fully aware of the value of power load and had done his utmost to secure it, but he felt it must always be gotten on a profitable basis. Except where a high load-factor justifies it, an extremely low rate is ridiculous, in fact even malicious. Too many small plants have gone under. It behooves central-station men, therefore, to stand together so as to secure rates that are profitable to the industry. It is not necessary to quote a ruinous rate to secure power customers. Economy of operation is the chief argument to be used in getting large power consumers on the lines; a careful study must be made of what the prospect's present power costs are and then he must be shown that electric power will be cheaper.

In opening the discussion, President Bryan said that not long ago the electric-lighting business was largely run on an excessively low flat-rate basis. Now many central-station men had almost

gone crazy about getting power load under any and all conditions. He had come across many instances of ruinously low power rates and knew how difficult it was to raise to an equitable basis a rate once established.

Mr. MacGregor cited a case where he had difficulty in making a mill owner put in a proper installation so as to secure a better load-factor.

W. D. Ray, of Hammond, Ind., concurred in most of what Mr. MacGregor had brought out in his paper, but he dissented from his comments on the work of manufacturers' salesmen. They have done a great deal to aid the central station in the development of power load and he had never known them to seek special power rates for their products. The central station should seek their co-operation. The manufacturers possess valuable data covering the performance of their motors and other machinery in contrast to the cost of steam or other non-electric equipments. In some instances low rates are justified by the conditions, as around Gary, Ind., where the establishment of isolated plants in many new industrial establishments was prevented by attractive but profitable rates. There must, however, be no discrimination and a fair rate schedule once established must be adhered to for all.

BERRIEN SPRINGS-ST. JOSEPH TRIP.

Directly after the morning session those attending the convention made an excursion to Berrien Springs and St. Joseph, Mich. Two special interurban cars were provided on the Southern Michigan Railroad, which carried the party first to Berrien Springs. Here a buffet luncheon was served in a grove on the banks of the St. Joseph River. An inspection was then made of the adjoining hydroelectric plant of the Indiana & Michigan Electric Company. This is one of a chain of plants owned by this company. The cars were then again boarded and the trip to St. Joseph continued. This place was reached about 4:30 o'clock, the party going to the Edgewater Club. A business session of an hour was held just before dinner. Shortly after 9 o'clock the party again boarded the special cars and returned to South Bend.

At the late afternoon session held at the Edgewater Club, C. E. Layton, of Lebanon, Ind., read his paper on "Rural Service."

RURAL SERVICE.

Mr. Layton first took up in his paper the value of electrical supply for agricultural purposes. It is of service not only for light but also for power. Many machines can be conveniently grouped under one roof and driven from one line shaft, since there is seldom need for operating more than one or two at a time. Among the machines that can be so operated are grindstone, circular saw, feed cutter, corn sheller, bone cutter, hay baler, etc. For pumping, all things considered, electricity is cheaper than a windmill and gives automatic control. Electric power is particularly servicable in the dairy for facilitating its operation and promoting its cleanliness. There should be an abundance of electric light in each building. Much progress along these lines has been achieved in Europe. A gasoline engine with generator is more of an investment than a transformer and line to the nearest central-station feeder. The central station will be glad to furnish the supply, if the farmer will pay for the poles and transformers. Where the entire cost of the extension falls on the station the business is not a profitable one. If the farmer wishes to enjoy the advantages of electric service, he should therefore co-operate in securing it.

The discussion was opened by President Bryan, who said he had received frequent requests for electric supply from farmers whose lands were near the numerous 25,000-volt transmission lines of the Indiana & Michigan Electric Company. He was compelled to refuse these requests because it was impracticable to install step-down transformers of the pole type for such high voltage and it was inexpedient to establish a large number of substations for the small load obtainable in the country. Where there were 600-volt direct-current railway substations, he had referred the requests to the railway company.

Mr. Palmer stated that before extensive building of rural lines was undertaken, it would be desirable to investigate carefully what voltage was most suitable. After trying this out it could be standardized and many lines built without fear that they would have to be remodeled at additional expense. Personally he thought that 4,000 would probably be better than either 6,600 or 2,300.

C. A. Elliott told of using 4,000-volt, four-wire, three-phase rural circuits near Muncie, Ind., and these gave good physical results with standard pole-type distributing transformers. Pole transformers cannot be used satisfactorily for 6,600 volts. However, he did not think that rural service was as yet a profitable investment. Most farmers will not co-operate in building the lines. In fact, the average farmer will deliberate over the spending of fifty cents as much as the central-station manager over the expenditure of $5.

Mr. Sterling said he had installed 6,600-volt lines with covered pole-type transformers supplying several farmers and summer cottages in Michigan. So far he had not had trouble from lightning or other causes, but, as the service had not been in operation very long, he would not extend it until it had been proved out more thoroughly.

Mr. Kyle declared that the North Shore Electric Company had been very successful in extending its 4,000-2,300-volt, four-wire, three-phase lines in the suburban districts about Chicago, and that many farmers were supplied from these lines. Mr. Harting also spoke of his experience with 2.5 miles of rural lines near Elwood.

Mr. Ray, of Hammond, expressed the conviction that serving farmers from central-station lines is now largely an unprofitable proposition because of the small load that can be obtained for a certain line investment. However, he believes that the farmers will become educated to the value of electricity and will furnish more demand as agriculture becomes more intensive. As suggestive of economical line construction, he told of the use of iron wires for primary lines on the North Shore Electric Company's rural system. That company has a large load of this kind and is developing it very rapidly. Mr. Ray thought that any prudently planned extension is bound to develop a diversified load and will therefore pay for its construction in a relatively short time. He cited a twelve-mile extension on his company's lines which he had built within two years and readily placed on a paying basis.

The session was concluded by a paper on "Economies of Operation Secured by Consolidation of Small Properties." In the absence of its author, L. B. Andrus, general superintendent of the Indiana & Michigan Electric Company, of South Bend, an abstract of the paper was read by Secretary Zartman.

CONSOLIDATION OF SMALL PROPERTIES.

Looking back at the history of the central-station business, Mr. Andrus points out near the outset of his paper that the early electrical properties were not profitable undertakings. They were largely in the hands of mechanics and engineers, who were quite skilful in the operating end of the business but lacked commercial instincts. Electrical plants were mostly started exclusively for lighting purposes and rapidly developed a pronounced peak load at the beginning of the few hours they operated each night. Separate power houses were built for street railways and in some instances for street lighting; large buildings and factories built their own isolated plants. Later it was found that a day power load was desirable for an electric light plant. Subsequently the discovery was made that a central power plant could supply all these divers electric services with a vast improvement in load-factor and in economy. Then the period

of consolidation began. In such consolidations it was found practically necessary to incorporate the organization. Mr. Andrus made a strong argument in favor of a corporation instead of individual or partnership ownership of utilities. This leads to economy in man power from the co-operation of capabilities. Consolidation brings about the greater economy of large units over small ones. It results in stability of the investment. The co-operation of hydraulic and steam plants is particularly desirable. The chief benefit, however, is the marked improvement in diversity-factor which brings with it a greatly improved load-factor for the large station.

THURSDAY'S SESSIONS.

A morning and an afternoon session were held at the Oliver Hotel on Thursday, the final day of the convention. The morning session opened with reports of committees. The Executive Committee recommended two amendments to the constitution, both of which were unanimously adopted. The first of these left the selection of the time and place of the annual meeting entirely to the Executive Committee. The second changed to April first and October first the dates when the annual dues are payable.

The report of the Nominating Committee was then read by the secretary, who was instructed to cast the joint ballot of the Association for the candidates recommended. The list of officers thereby elected is as follows:

President—F. A. Bryan, of South Bend (re-elected).

Vice-president—Felix L. Cadore, of Vincennes.

Secretary-treasurer—J. V. Zartman, of Indianapolis (re-elected).

Executive Committee—R. A. MacGregor, of Connersville, chairman; E. Darrow, of Indianapolis; W. D. Ray, of Hammond; and T. Donohue.

Advisory Committee—C. C. Perry, of Indianapolis, chairman; T. C. McReynolds, of Kokomo; J. W. Robb, of Clinton.

Finance Committee—C. Blank, of Martinsville, chairman; Thomas A. Grist, of Knox; J. N. Moncrieff, of Bloomington.

C. C. Perry, a past-president of the Association, brought up the desirability of the organization interesting itself in Indiana public-utility legislation. Attempts had been made to pass utility-commission laws at the recent session of the Legislature; while these had failed there was already talk of renewing the attempt two years hence. The utilities had nothing to fear from an equitable commission, but they did not propose to submit to a grossly unfair one, as was the case in a few states. Mr. Perry therefore recommended that the Association co-operate with similar bodies to have a commission appointed to investigate the subject thoroughly and to draft legislation establishing a permanent commission on a broad and fair basis. Messrs. Ryan and Robb spoke along somewhat similar lines and on motion of Mr. MacGregor the matter was referred to the officers and Advisory Committee for further action.

President Bryan in an appropriate speech, in which he referred to the greatly broadening work of the National Electric Light Association and to the movement for affiliating the state associations with it, introduced John F. Gilchrist, of Chicago, president of the National Electric Light Association. Mr. Gilchrist made an extemporaneous address on

AFFILIATION WITH THE NATIONAL ASSOCIATION.

At the outset of Mr. Gildchrist's address he told of the rapid development of the central-station industry and of the need that was realized a few years ago of extending the work and influence of the National Electric Light Association so as still further to promote and to co-ordinate this progress. At the instance of Past-president Henry L. Doherty arrangements were made to affiliate geographic sections, such as the state associations, and to establish local company sections. The scheme was something like that of the relations of our national and state governments. The latter are supreme in their sphere, they make their own rules and conduct meetings as they choose. The president of each affiliated state association becomes a member of the Executive Committee of the National Association. All members of the state association are required to be members of the national organization. One-half the dues paid in by these members to the latter body are set aside for the use of the state association. There are now about ten of these affiliated associations. This is an age of co-operation. The industry needs every man connected with it to understand its interests and to work in harmony therewith. This is being accomplished through the company sections. In a larger sense the state affiliations are promoting co-operation and stability. Mr. Gilchrist also told briefly of the advantages of N. E. L. A. membership, of the work and publications of the Association and of its prospects for further betterment.

Messrs. Bryan, MacGregor and Robb spoke of the many advantages that membership in the N. E. L. A. had brought to them, the *Question Box* alone being regarded as worth many times the nominal dues paid every year. Mr. Bryan said he would organize a company section in South Bend. Later in the day the subject of affiliating the Indiana Association with the National Association was again brought up and referred to the Executive and Advisory Committees for consideration.

Two papers on steam turbines concluded the convention; both were illustrated by lantern slides. The first "The Steam Turbine for Future Work," was presented before the luncheon recess by E. D. Dreyfus, of the Westinghouse Machine Company. At the afternoon session G. R. Parker, of the General Electric Company, read his paper on "Curtis Steam Turbine Installations."

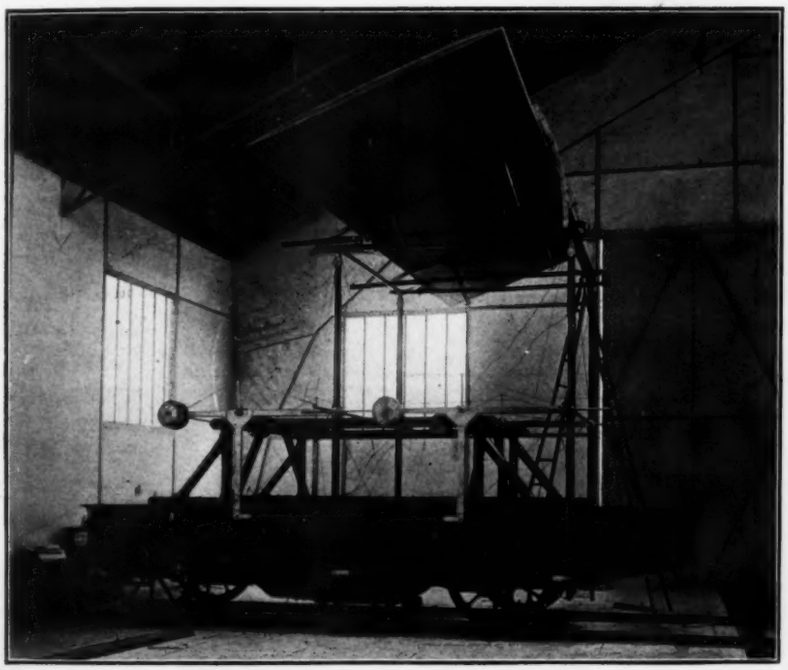
STEAM TURBINES.

Mr. Dreyfus opened his paper by alluding to the extremely rapid development of the steam turbine during the last ten years, there being now about 20,000,000 horsepower in these units in service. They varied in capacity from a fraction of one kilowatt to the largest prime movers in the world, one builder being ready to construct 30,000-kilowatt machines. Both the impulse and reaction principles are applied in all steam turbines but, as one or the other predominates, it gives its name to the type. Mr. Dreyfus described both the high-pressure and low-pressure types of turbines and the advantages of each class, as well as those of turbines in general. The capacity of engine plants has been nearly doubled by the installation of low-pressure turbines without material change in the boiler equipment or coal consumption. A type known as the bleeder turbine has been developed to permit steam to be withdrawn from an intermediate stage for use in exhaust-steam heating systems; these turbines have automatic valves for governing the amount of steam withdrawn to just satisfy the heating requirements; these machines are particularly designed for plants furnishing both electric and heat supply. Mr. Dreyfus gave many classes of service where turbines are used, to show the very diversified work they are capable of. He then discussed mechanical construction in some detail. Much advance has been made along these lines. In general the stresses in turbines are less severe then in reciprocating engines because of the relatively low speed of the latter. Both the operation and regulation of turbines is better than with engines; the uniformity of angular velocity permits excellent parallel running. Taking up questions of design, it was noted that the reaction type does not need such sharp edges as the impulse turbine; therefore slight erosion or corrosion in the latter is more noticeable in its effect on efficiency. In conclusion Mr. Dreyfus advised against the maximum continuous ratings of some makers as not being desirable for general use.

Mr. Parker first gave a brief historical review of the steam turbine. Taking up the construction of various types, he gave particular attention to the Curtis turbine and illustrated its details. He said that erosion and corrosion are present in all turbines to a slight degree, but this is of insignificant effect except in a few special cases. Modern alloys prevent corrosion; superheated steam eliminates erosion, which is due almost entirely to water carried over in the steam. Mr. Parker showed pictures of turbines that had been taken down after five to seven years of continuous service and showed substantially no wear of buckets or guides. He discussed the value of the low-pressure turbine and showed typical installations. In the mixed-pressure turbine the low-pressure nozzles extend three-fourths of the way around the machine and the high-pressure nozzles the remaining one-quarter of the way. They permit of either low or high-pressure supply or both. Turbines are also built in which some low-pressure steam can be extracted between stages or supplied thereto. By regulating nozzles of one stage, the amount of steam going to the low-pressure stage and to the

heating system can be adjusted as desired, making a very flexible machine. Among many installations shown, was one in St. Louis where a 5,000-kilowatt unit was removed to make room for a 12,000-kilowatt machine without substantial changes in the foundation, such has been the progress of the turbine art.

Both these papers were briefly discussed together. In reply to some questions about ratings, Mr. Parker explained the system of continuous rating as referring to that capacity which the machine will yield in continuous operation without overheating any of its generator coils. The armature is the limiting element, since the fields are generally provided with asbestos insulation and are not subjected to high voltage. If careful watch is kept of the armature temperature, the continuous rating may be exceeded, because it is not the maximum capacity that may be attained.



ELECTRIC CAR FOR TESTING AEROPLANES.

After the adoption of resolutions expressing the gratitude of the Association for the work of the officers, particularly President Bryan, the convention adjourned.

Acetylene at the Coronation.

In connection with the illuminations at the recent coronation a noteworthy feat was accomplished by the lighting of St. Edward's Tower and the whole of the west front of the Roman Catholic Cathedral at Westminster by means of acetylene. The tower is 300 feeet high, and lights equivalent to 15,000 candlepower were fixed at its top.

Electric Devices for Aeroplane Tests.

Electrical devices are to be largely used in the new Aerotechnical Institute which has lately been founded in France. It forms part of the Paris University and the original idea is due to Henri Deutsch, who endowed it with a fund of $100,000 as well as an annual income of $3,000. Of especial interest are the electrical devices used for testing aeroplane surfaces. Such surfaces are mounted upon a special electric car and are fixed to the top of the car upon a pivoted frame. By means of this frame, the wind pressures on the surface in different directions are transmitted to registering dynamometers on the car. In order to run the car for some distance and obtain high speeds, a 4,600-foot track is laid out in a straight line and, instead of having a pilot on the car, controlling means are located on a high platform on the top story of the building and overlooking the track. On each side of the track is a current rail mounted upon posts, and provisions are made for varying the current both in field and armature of the car motor by a controller placed at the lookout post.

The motor field is generally excited at 120 volts, while the controller varies the current in the armature from 50 to 500 volts, according to the speed at which the car is to be operated. On the switchboard is mounted an automatic device for working at a certain standard speed after starting the car, so that once the device is adjusted for the proper maximum speed, the car operates without further attention.

The car frame is mounted on two axles of twelve-foot base, and its total length is twenty feet. It runs on standard-gauge track. The motor, of the Thomson-Houston ironclad type, is of special design, seeing that it is required to drive both axles. For this a double chain drive is used. The motor is mounted five feet from the front axle and seven feet from the rear, so as to bring the weight forward and so prevent the upward pressure of the wind from lifting the car off the track. When at the end of its course, the car is slowed up and finally stopped by using a pair of horizontal brake shoes which run upon a pair of flat friction rails, these being run for some distance from the end of the track.

The position of the brake shoes is set at the start by a hand wheel and endless screw, and when at the end they are lifted off in the same way. A switching box is interlocked with the brake mechanism so that when the brakes are lifted up and in the off position, only 120 volts or slow speed can be used on the car. When the brakes are put down, the full current can be applied, as it is now certain that the car will be stopped. Besides this, electric braking on the motor can be used at any time by the pilot. The present electric car can be run at about 100 feet per second and Prof. Maurain, who is head of the Institute, is obtaining some useful data with it. As soon as the car is well tested, a number of others will be used on the track and these will be designed for testing screw propellers and for other purposes.

A round covered building has been built for similar tests, but here the track used will be circular. Such tests can be made in all seasons, and they are more easily carried out than with the car, especially for preparatory work. The building is 125 feet in diameter and in the center is a pivot about which a circular mechanism is made to rotate. A fixed twenty-horsepower motor drives a long arm which rotates around the track, and on the arm are mounted various kinds of aeroplane surfaces to be tested.

For working with propellers a second thirty-horsepower motor is mounted on the arm itself so as to drive the propeller. The arm now rotates around the track by the action of the screw alone, but if desired the fixed motor can also be used for this purpose.

AUTOMATIC CIRCUIT-BREAKERS. —II.

BY STEPHEN Q. HAYES.

Fig. 9 shows a breaker built in single-pole units in capacities up to 3,000 amperes at 600 volts, and 100 amperes at 33,000 volts, and having an ultimate breaking capacity of 6,000 kilovolt-amperes for two units on a single-phase circuit, 10,400 kilowatts for three on a three-phase, and 12,000 kilowatts for four on a two-phase. Each pole of the breaker is intended for mounting in a masonry compartment, and two-, three- or four-pole units are made by connecting the solenoids of two, three or four poles to the same operating circuit. The mechanism and the terminal insulators are mounted on a treated-soapstone base and a simple system of toggles operated by a powerful solenoid is used for closing the breakers. A second solenoid is used to upset the toggle and trip the breaker. A single-pole, double-throw switch is mounted on the breaker and is operated by the motion of the levers in opening or closing the breaker. This switch controls the signals on the switchboard.

Fig. 10 shows a number of solenoid-operated top-connected breakers of 600 amperes capacity at 13,200 volts. This type of breaker is built in capacities up to 3,000 amperes and in voltages up to 33,000, and is used in stations of the largest capacity. Each pole of the breaker is inclosed in a separate fireproof masonry structure and a single powerful mechanism mounted on an iron base and resting on a treated-soapstone slab is used with a two-, three- or four-pole breaker. The cone contact on the smaller sizes and the brush contact on the larger, as well as the general design of this breaker and previous breakers are such that the tendency is to open rather than to stick, and as the open position is maintained by gravity, failure of the mechanism, breakage of the operating rods or other unforeseen contingencies will cause the breaker to fall open rather than closed.

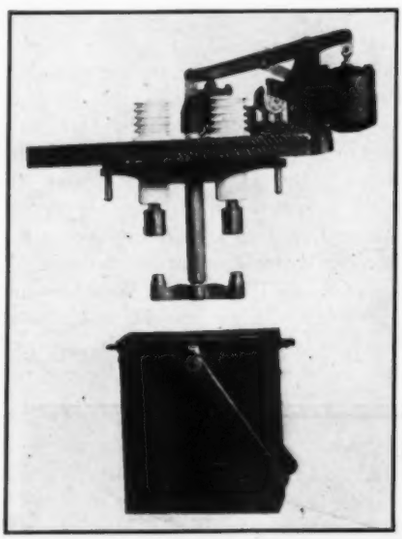


FIG. 9.—300-AMPERE SOLENOID-OPERATED OIL CIRCUIT-BREAKER.

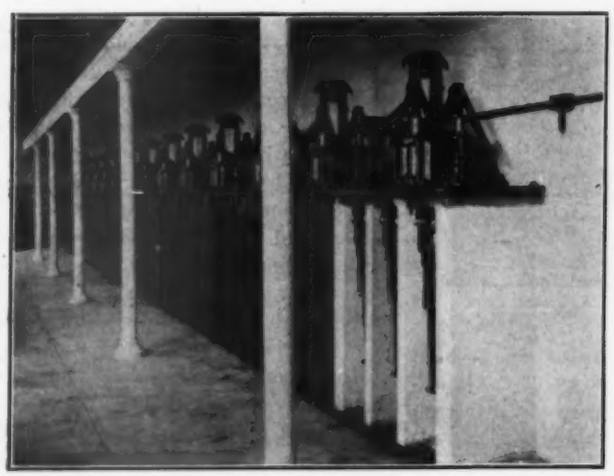


FIG. 10.—600-AMPERE SOLENOID-OPERATED OIL CIRCUIT-BREAKER.

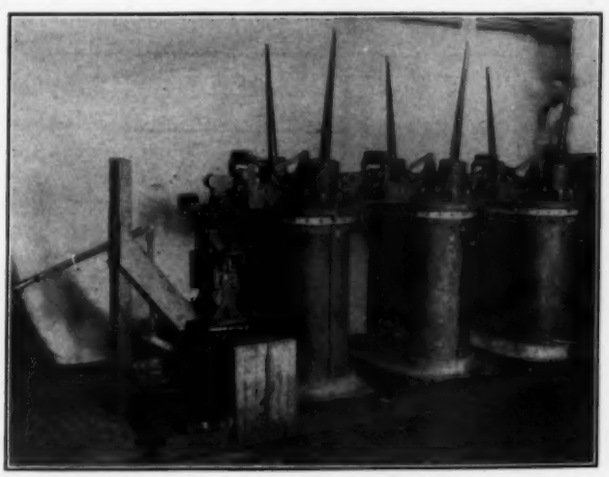


FIG. 11.—44,000-VOLT HAND-OPERATED OIL CIRCUIT-BREAKER.

Both terminals of each pole are in a single metal tank with insulated lining and each tank is provided with a gauge glass for observing the height and condition of the oil. In the particular installation shown in the cut, the circuit-breakers are mounted in concrete structures and provided with sheet-iron covered doors. The breakers can be placed if desired in brick structures and the doors of the compartment are frequently furnished with clear wire-glass panes to permit ready inspection. The leads of this breaker leave the top of the tank and pass out through porcelain bushings set in soapstone blocks in the back wall of the structure. These leads usually come out in separate compartments that keep them isolated from each other, and the leads to the busbars, feeders, generators, etc., may all run upward or all downward or some up and some down. This flexibility is often a great advantage in permitting the generator breakers being placed on one floor with the busbars above them and below the feeder breakers, thus minimizing the amount of space required and the amount of material needed. Another advantage of this type of construction is that it permits mounting the disconnecting switches for isolating the oil circuit-breakers on the back wall of the breaker structure, and when so located there is far less chance of an attendant closing these disconnecting switches while a second attendant is working on the breaker than if the switches were on one floor and the breaker on the other.

Fig. 12 shows a 3,000-ampere 2,400-volt circuit-breaker of this design temporarily mounted on a truck for the purpose of transportation. This breaker is provided with laminated brushes for the main contact and brass rods for the auxiliary contacts. In actual service this breaker will be located in masonry compartments.

The breakers shown in Figs. 9, 10 and 12 are made automatic by the use of relays actuated by transformers and are

primarily intended for use in power plants where the cellular construction for the busbars, wiring, etc., is needed or desired. In generating stations of about 6,000 kilowatts and upwards where the generators feed into busbars and the entire output of the station may be concentrated on a ground or short-circuit, it has been found of the utmost importance to isolate the busbars, wiring, and connections in fire-proof masonry compartments in such a manner that leads of opposite polarity are separated by soapstone, concrete, brick or similar material. These fire-proof walls, barriers, septa, etc., prevent an arc starting in one place and communicating to the adjacent conductors. The amount of current available momentarily at the point of trouble in large stations of 13,200 volts or less, where the generators are connected to a bus, is something enormous, and every precaution must be taken to prevent such trouble from spreading. For such voltages the question of obtaining suitable distance between wiring and ground is a comparatively simple one.

Where the generators are connected to step-up transformers giving voltages from 33,000 to 140,000 or even higher, the question of inclosing the busbars and wiring for the high-tension circuits becomes an entirely different proposition, and for such service it is the opinion of many engineers that the open system of wiring is preferable, as the striking distance from wire to ground has to be greatly reduced if masonry compartments are employed over what could be obtained with open wiring in the same space, and the fire-proof barriers offer a more or less perfect ground for high-voltage circuits and the higher the voltage the more perfect the ground. Moreover, a more expensive building and more costly construction are usually needed with inclosed busbars than with open wiring. Inspection and repair are more difficult for busbars, wiring, disconnecting switches, etc., that are boxed in masonry compartments and only visible and accessible by the removal of doors, than if everything is in plain sight. Inspection will be more frequent and thorough and incipient trouble will be noticed far sooner with open wiring than with inclosed, as the station attendant in a few minutes' walk can see everything and does not have to remove many doors and visit two or three floors to examine the condition of the apparatus. The high-voltage breakers, Figs. 11 and 13, are primarily intended for open wiring but can of course be used with inclosed busbars and wiring.

For high-voltage service, the development of the condenser type of bushing with its capacity distributed in such a way as to secure a practically uniform potential gradient throughout the mass of the insulation, has facilitated the design of high-tension oil circuit-breakers. Due to the fact that there is practically no external static field where the lead passes through the top of the case, a cast-iron cover can be used with the bushings solidly clamped to the cover. This construction permits the assembling of all of the mechanism on this cover and greatly simplifies assembling and inspection.

Fig. 11 shows a 44,000-volt, three-pole, 300-ampere breaker arranged for distant mechanical control and temporarily set up for the purpose of testing.

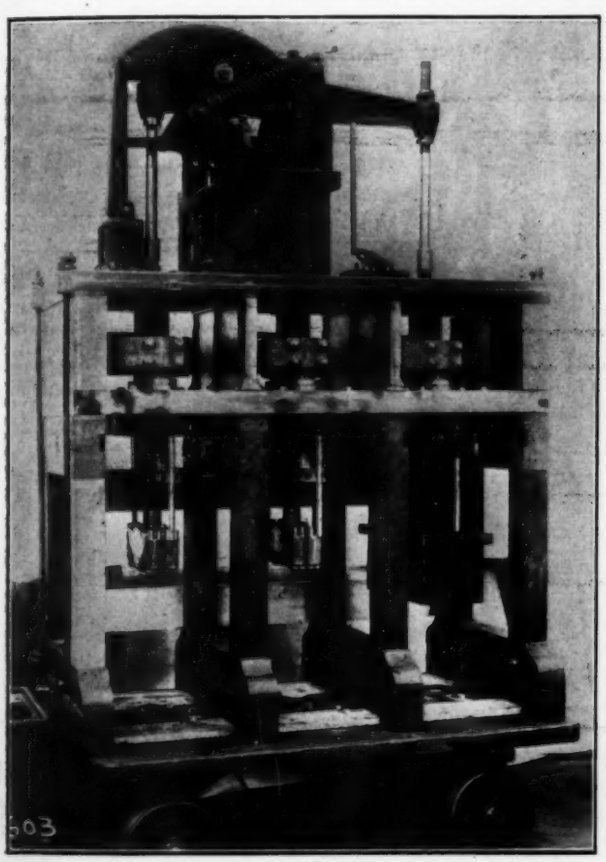


FIG. 12.—3,000-AMPERE SOLENOID-OPERATED OIL CIRCUIT-BREAKER.

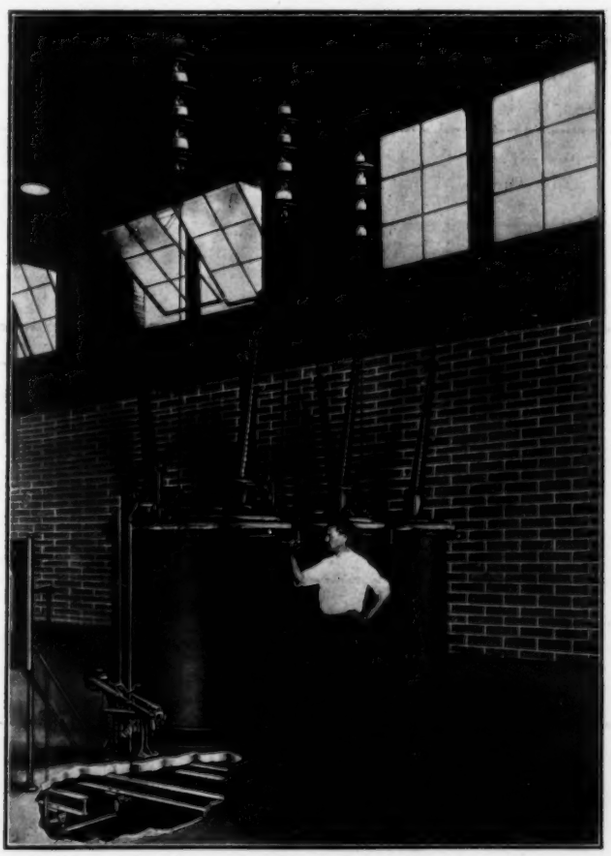


FIG. 13.—100,000-VOLT HAND-OPERATED CIRCUIT-BREAKER WITH SERIES TRIP.

Each pole of the breaker is located in a welded-steel tank with treated lining and is complete with all of its mechanism on its cast-iron top. As each pole is entirely independent, with the operating rod forming the only connection between them, the spacing of the poles can be made to suit the station wiring. For electrical operation a solenoid replaces the bell-crank device.

The operating mechanism of each pole consists of a toggle actuating a simple system of levers and links with the pull rod connecting the poles so that all open and close with the same movement and so that all adjustments are made after the mechanism has been assembled on the cover and before the latter is placed in the oil tank. This breaker has its stationary contacts deeply immersed in oil and screwed directly on the end of the brass tube that forms the lead through the condenser bushing. The movable contacts are self-alining and the contacts are provided with a heavy spring that is compressed when the breaker is closed. These movable contacts are carried by a heavy cross bar and the current is transmitted through braided shunts so that the compression springs will not be damaged by the passage of the current through them. When closing a wiping motion is obained until a solid butt contact is reached. Both the stationary and movable contacts are readily removable.

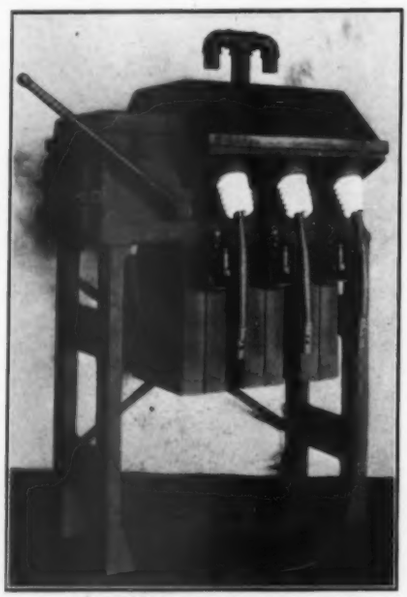


FIG. 14.—300-AMPERE OUTDOOR-TYPE OIL CIRCUIT-BREAKER.

Where the pull rod passes through the cast-iron cover a stuffing box is provided that acts as a wiper in removing oil from the rod. The cover is securely bolted to a flange riveted to the upper edge of the tank and all hand holes are provided with dust and moisture-proof hinged covers. The hand holes in the top are of sufficient size to permit the easy removal of the removable contacts and cross bars without disconnecting the other parts of the circuit-breaker. The condenser-bushing leads that form the stationary terminals can readily be unclamped and removed through the cover. As may be noted, the series transformers for the operation of ammeters and relays are clamped directly around the condenser-bushing leads which form the single-turn primary. This permits the use of a single compact and cheap form of series transformers.

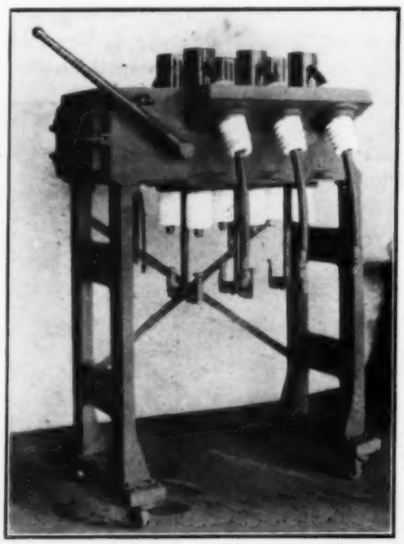


FIG. 15.—OUTDOOR-TYPE CIRCUIT-BREAKER WITH COVERS OFF.

Fig. 13 shows one of the type of breaker supplied to the Southern Power Company for its 100,000-volt line, while similar breakers have been furnished for the 110,000-volt circuits of the Hydro-Electric Power Commission of Ontario.

This particular breaker is hand-operated and the automatic operation is obtained by means of series solenoids connected directly in the high-tension circuit and suspended from line insulators. These solenoids have their plunger mechanism connected through long wooden rods to the tripping device of the breaker and in case of an overload or short-circuit mechanically trip out the breaker. Both of the breakers shown in Figs. 11 and 13 can readily be arranged for electrical operation by replacing the hand closing device by a solenoid mechanism.

OIL CIRCUIT-BREAKERS—OUTDOOR TYPE.

All of the breakers previously described are intended for mounting indoors where they will not be exposed to the weather. The latest developments however, in circuit-breaker design, have provided for outdoor service, as this obviates the necessity of a building in many cases.

Fig. 14 shows an outdoor type of breaker designed for 300 amperes at 13,200 volts, while a modification of this breaker is suitable for still higher voltages. As may be noted, the mechanism is completely covered up by a weather-proof housing provided with an air pipe for ventilation. Automatic operation is obtained by means of a tripping device fed from the secondaries of current transformers located under the weather-proof housing.

The three small wires leaving the bottom of the housing are connected to the middle and the two outside studs of a double-throw signal switch, mechanically actuated by the mechanism of the breaker, and these are used for lighting up red or green indicating lamps to show the open or closed position of the breaker. Each pole of the breaker is in a separate oil tank provided with an oil guage for observing the height and condition of the oil.

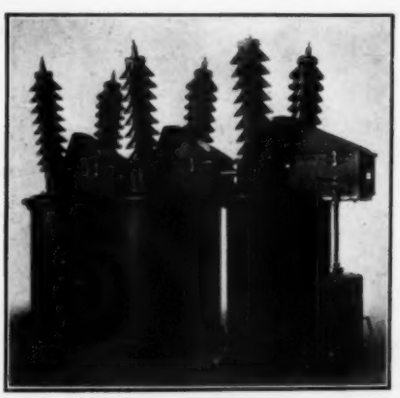


FIG. 16.—100,000-VOLT OUTDOOR-TYPE OIL CIRCUIT-BREAKERS.

Fig. 15 shows the same breaker with the oil tanks and housing removed. As may be noted, butt contacts are used and the general features of this breaker correspond with that shown in Fig. 6 and described previously.

Fig. 16 shows the corresponding 100,000-volt breaker intended for outdoor service, electrically operated, and its main features correspond closely with Figs. 11 and 13 previously described. For outdoor service the condenser-bushing leads of the breaker are covered

with a series of porcelain insulators and the space between the bushing and the insulators is filled with a moisture-proof compound. The operating mechanism is covered by a metallic hood and the pull rods connecting the various poles of the breakers pass through pipes. The various joints are made thoroughly waterproof and outdoor breakers of this design have been operating very satisfactorily on the lines of the Dominion Power and Transmission Company near Hamilton, Ontario, the Niagara, Lockport and Ontario Power Company near Niagara Falls, N. Y., and the Southern Power Company.

While it is felt that this description of the automatic oil circuit-breaker is more or less incomplete, it will at least give a general idea of the trend of design for such breakers.

Lighting Plans for Los Angeles.

Request has been made by the city electrician of Los Angeles, Cal., that the Board of Public Works shall issue definite information as to the plans of the city in regard to street lighting when power from the aqueduct is available. The city budget provides for an additional 360 arc lamps to be installed, making a total of 3,560. For such service, obtained from the Los Angeles Gas & Electric Company, the city pays $75.60 per lamp a year, a total of $269,136 for the system.

An endeavor to establish lower rates with the company has met with the company's refusal until it learns that its lighting system will eventually be taken over by the city at a fair valuation, or whether the city contemplates an entire new system. The matter has been referred to the Power Bureau.

Prevention of Electrolysis.

In a report on electrolysis of pipes in the City of Chicago, mention is made of the way in which electrolysis of gas mains was prevented by the Peoples Gas Light & Coke company. This company employed the method of bonding the gas mains in the affected territories to the car rails with copper wire. In this way stray currents were conducted from the rails without damage. Each joint (twelve feet apart) was bonded with two copper wires, and at a number of places copper cables, varying from 500,000 to 1,000,000 circular mills were tapped into the gas mains and carried to the negative busbars at the power stations.

Meeting of the Central Electric Railway Association.

The annual convention of the Central Electric Railway Association held at Cedar Point, O., August 23 and 24, was declared by the officials to be the best attended, most enthusiastic and enjoyable in the history of the Association. A noticeable feature of the meeting was the number of cars brought from distant points. Where no physical connection between the electric systems could be had the cars were transferred to steam lines and hauled over the gaps. The longest distance traveled was from Peoria, Ill., to Sandusky, O., a distance of about 500 miles. The private car making this trip was in charge of H. E. Chubbuck, vice-president of the Illinois Traction System.

In calling the meeting to order Wednesday morning, President E. B. Peck, of Indianapolis, congratulated the Association on having at this convention the largest attendance in its history. As a matter of further congratulation he said the meeting was honored with the presence of representatives of three other electric railway associations, including A. W. Brady, of Indiana, president of the American Electric Railway Association; H. E. Chubbuck, president of the Illinois Electric Railway Association and James Anderson, president of the Canadian Street Railway Association. The three presidents responded briefly to the president's introduction.

Mr. Chubbuck was heartily applauded as a result of his announcement that he thought in the near future the principal traction systems of Illinois would apply for membership in the Central Electric Railway Association. President Peck thanked Mr. Chubbuck for his fraternal promises and said that the merging of the Illinois Association would prove beneficial to both associations.

The preliminaries of the convention having been attended to at a business session the regular program was taken up and continued through the various sessions of the meeting.

"Headlights for Interurban Cars," was the subject of a paper read by C. Dorticos, of the General Electric Company. Mr. Dorticos said that in the early installation of traction service intensity of illumination of the track was not a serious problem, but with the increasing use of the highway crossings and larger power, improved road beds, higher schedule speeds, etc., the danger has correspondingly increased, necessitating different types of enclosed carbon lamps to be installed. Mr. Dorticos described the several types of lamps now in use showing in each case the simplicity in design, cost of maintenance, etc., under different conditions of service.

Mr. Dorticos' paper was discussed by R. M. Hemming and other members of the Standardization Committee and Mr. Dorticos said his company wished to cooperate with the Standardization Committee and that he would prepare data covering the requirements suggested by that body.

The next paper was read by H. M. Staats, of Cleveland, O., on the subject, "Insurance." Mr. Staats has been appointed to the position of insurance expert of the Association, and pointed out many ways that would result in great savings by lessening the hazards by the adoption of modern and scientific means to prevent and extinguish fires.

In the discusion of Mr. Staats' paper it was brought out that the traction companies were imposed upon by inspectors who worked in relays. One inspector would order certain improvements and after being installed at great expense another inspector would come along and declare that the improvements just made were unnecessary and order other improvements equally expensive. Mr. Staats said this imposition would be soon regulated.

Albert Schlessinger, superintendent of overhead construction, of the Terre Haute, Indianapolis & Eastern Traction Company, read a paper on "Overhead Standardization." He remarked that little has been accomplished in the way of standardizing material and methods of installation of overhead construction. He pointed out the necessity of employing uniform fittings and keeping a large stock of supplies on hand so that when any part is worn out a piece of different design need not be used to replace it.

Mr. Schlessinger described the various forms of material and methods of construction now employed by traction lines covering the entire subject, including even a description of telephone equipment. This paper brought out a lively discussion by J. E. Cochran, of the Ohio Electric Railway Company, H. E. Garbitt, of the Westinghouse Electric & Manufacturing Company, D. D. Hames of the Electric Service Supply Company, H. E. Burdick, of the

Detroit United Railway and C. Dorticos of the General Electric Company. Mr. Schlessinger answered the numerous questions propounded in a clear and instructive way and all declared that the paper and discussion resulted in the giving of much needed information.

"Little Things That Count" was the subject of a paper presented at the opening session Thursday morning, by John C. Schade, Secretary of the Winona Interurban Railway. Mr. Schade said that the interurban railway service is still in its infancy and it will stand considerable improvement. New things are being brought out every day making changes necessary. New fields are continually opening up in the traffic department, necessitating the standardization of equipment and methods of operation so as to develop through business and make possible the expeditious handling of local business. He characterized standardization as the "Rock of Gibraltar" of the traction business.

Mr. Schade described in detail the little things that count and cited interesting experiences where difficulties were overcome because of a close adherence to small requirements. He said the best advertisement for a road was a well equipped train kept on schedule time with all the conveniences in place, from a drinking cup to an electric fan—the latter to be the next requirement of interurban travel. He also said too much attention cannot be given to the proper lighting of cars. Poor lights are conducive to much complaint. Mr. Schade urged interurban men to point out little defects observed in traveling over other lines and while offense might be taken, great good in the end would be the result.

Oliver E. Anthony, baggage agent at the interurban station in Indianapolis, the largest terminal station of the kind in the world, read an interesting paper on "The Troubles of a Baggage Agent." Mr. Anthony pointed out the main causes leading to trouble in handling baggage and showed the best plan of disposing of complaints. Courtesy and politeness, he said, toward passengers with baggage were the greatest and most effective things to employ in turning away the wrath of passengers who insist on having their baggage checked and loaded instanter regardless of condition, weight or storage charges. Mr. Anthony asked that a campaign of education be started among the patrons of interurban roads, as well as station agents, in order to make the life of a baggage agent at a large terminal worth living.

"Trailer Operation versus Multiple-Unit Trains," was the subject of an interesting illustrated lecture by Clarence Renshaw of the Westinghouse Electric & Manufacturing Company.

Mr. Renshaw took strong grounds against the trailer in favor of the use of the multiple-unit trains. He thought in view of the many advantages of the latter over the former in handling crowds the employment of trailers was a mere make-shift when compared to the use of a train of two motor cars.

Mr. Renshaw's lecture brought out an animated discussion in which H. A. Nicholl, of the Indiana Union Traction Company, M. R. Shneider, of the Cleveland, Southwestern & Columbus and H. E. Burdick of Detroit United, participated. It was the general opinion that the use of the trailer was the best way to solve the problem in the absence of expensive installation of multiple-unit car equipment station and line equipment. Many successful experiments were cited of instances where trailers were used without overloading the motors.

The Executive Committee announced that next regular meeting of the Association would probably be held at Louisville, Ky., November 23.

Oil Used in Place of Coal.

The small production of coal in California is offset by the enormous increase in the production of petroleum, most of which is used for fuel. The oil produced in California in 1910 aggregated between 65,000,000 and 70,000,000 barrels, which, on the basis of 3.5 barrels of oil for each ton of high-grade coal, would be equal to a production of nearly 20,000,000 tons of coal.

The use of petroleum by the transportation and manufacturing industries of California has practically eliminated coal as a steam-raising fuel in the state. Oil is also used in the manufacture of gas which is employed for cooking and for heating residences as well as for lighting. Oil is now also coming into use as a direct fuel for household purposes.

China has the greatest deposits of iron ore in the world. Its first shipment of pig iron for export was made during the past year to America.

LETTER TO THE EDITOR.

New Standardization Rules.

To the Editor:

In the editorial on the "New Standardization Rules," appearing on page 354 of your issue of August 19, I note the following sentence:

"These rules have been published in the issue of the *Proceedings* for August. Some of the new material has not had the benefit of general criticism and has probably suffered thereby. It is to be regretted that the entire list of changes was not submitted to the membership for criticism in accordance with the resolution adopted at the Jefferson convention."

It appears from a circular issued from this office that the request for criticisms was distributed to the membership on July 15, 1910, and practically the same matter was printed in the August, 1910, issue of the *Proceedings*. I enclose herewith a copy of the circular, also pages 8 to 11 of the *Proceedings*, which I am sure will satisfy you that the membership was given ample opportunity to suggest changes in the proposed amendments to the rules. It has been my experience that members frequently neglect to give immediate attention to matters of this kind, and eventually, when it is too late, appear to forget that ample opportunity was given to them to offer suggestions. As the statement printed in your issue of August 19 implied an oversight on the part of the secretary of the Institute, I am sure you will see the importance of making a suitable correction.

RALPH W. POPE,
Honorary Secretary.

New York, N. Y., August 25, 1911.

In the editorial referred to it was not intended to imply that there had been any oversight or neglect upon the part of the secretary. The circular referred to by Mr. Pope is on file in this office and was referred to in connection with this editorial. It was observed that a great many of the changes made were not included in that circular, but have been added since the circular was issued, and the statement was one of great regret that the *entire* list of changes had not been submitted to the membership for criticism. The two definitions referred to of cycle and form-factor are examples of new matter not contained in the circular of July 15, 1910, nor in the issue of the *Proceedings* for August of that year.—EDITOR.

Central-Station Practice

Internal-Combustion Engines for Electric Power Stations.

The history of the development of electric generating stations could almost be divided into a series of definite phases, or ages, each characterized by a different form of prime mover. Indeed, the history of electric generators could almost be similarly divided, since up to the latest developments of the steam turbine, the electrical end of a generating set represented a form which had come into existence merely owing to the demand created by the development of its engine end. The phases into which electric generating stations could be divided might be known as the belt-driven age, the direct-coupled high-speed-engine age, and the steam-turbine age. This classification is, of course, an approximate one only, and intermediate stages and individual cases have at all times cropped up which have interfered with its simplicity. None the less, this division into ages is a fair representation of facts.

A tendency at any particularly time towards uniformity of practice in generating-station design carries with it at least two evils. The first of these is illustrated frequently enough in the present steam-turbine age. If the type of prime mover to be adopted in any particular case is to be determined merely in forms of conformity with ruling practice, many examples will be found in which such conformity has resulted in the installation of unsuitable plant, or, at any rate, plant which was not the most suitable. Such examples are found at the present time in the form of steam turbines of small capacity, having no advantages over reciprocating engines, and some disadvantages as compared with them, installed in some cases on quite a small scale in reciprocating stations, and having no justification beyond the fact that at the moment it is the fashion to install turbines. The second evil is that a fashion in terms of any particular type of prime mover is likely to render the introduction of any new or improved form a matter of greater difficulty than need be. It may appear that the fact of the rapid advance of steam turbines, and the supersession of direct-coupled high-speed engines by them, goes to show that this evil is small or non-existent; but we think that an examination of the facts of the case will show this deduction to be unsound. Although in a way steam turbines have superseded high-speed engines as the fashionable prime mover, they have not superseded them in the way that metallic-filament incandescent lamps have superseded carbon-filament lamps. The coming of the steam turbine in generating-station practice was not properly an example of a new form taking the place of an older, since the extent of the work to be done increased so greatly at about the time of the introduction of the turbine. The general adoption of turbines was undoubtedly greatly assisted by the fact that they displayed such aptitude for driving the large electrical units which the rapid extension of the field and scale of supply rendered necessary. If the mission of turbines had merely been the taking over of work on the same scale as it was being carried out by reciprocating engines, it is doubtful if they would have made the rapid advance which has been seen.

During the last few years a new type of prime mover for generating-station use has come into the field in the form of the internal-combustion engine. A considerable number of examples of this class have already been installed and have proved successful. These have taken the form both of gas engines and Diesel engines, and although the whole subject is still one around which a large amount of discussion revolves, it is by this time quite certain that either of these types is capable of forming the basis of successful plants. None the less the extent to which internal-combustion engines are used in generating stations is still very small as compared with steam plants. This is particularly the case as regards municipal stations, which tend to illustrate, more than others, the fashionable practice of the moment.

It is an interesting speculation as to whether the next decade will see the beginning of an internal-combustion-engine age in generating-station design, in the sense that the present is the turbine age. Many gas-engine and Diesel-engine enthusiasts would undoubtedly say that it will, but, personally, we certainly have no intention of committing ourselves to any such prophecy. It will be remembered that Mr. Ferranti, whose prescience in some matters has been remarkable, decided against gas engines in the large central generating-station scheme which he sketched in his presidential address to the Institution of Electrical Engineers. None the less, it must be remembered that this scheme was but a sketch intended rather to illustrate an idea that to stand for detailed practice. It is, of course, impossible for anyone to lay down the law as to the future line of development of any branch of engineering, and although non-believers in the internal-combustion engine may point out that the gas engine is of much older standing than the steam turbine, in the modern sense, and that the latter's relatively greater progress is proof of its superiority for generating-station use, they do not really make any case against the former. Their argument is a parallel one to that which might have been advanced to Sir Charles Parsons twenty-seven years ago, when it might have been pointed out to him that the inferiority of the turbine to the reciprocating engine was definitely established by the fact that it had been in existence since the days of Hero, and had been surpassed in every way by the reciprocating engine.

Although quite a good deal has by now been done in this country with gas-driven generating stations, none the less the number of such stations is as yet insufficient for there to be any great amount of data available to enable them to be compared with steam stations. The local conditions and management of different stations varies so much that a large number of examples are necessary before it is possible to draw any general conclusion which

may be considered fairly applicable to a particular type of plant. This fact, of course, militates against the rapid spread of new methods unless they show such remarkable advantages in the examples existing that it is impossible to ignore them. There are several large gas-driven stations now at work in this country, but they are mostly situated at private works, and in many cases the local conditions are specially favorable, so that the average engineer probably feels that both the extent and conditions of the present practice are not such as to justify him in adopting a similar type of plant for his own use. An additional hindrance to the spread of the gas engine for generating-station work lies in the obvious fact that it cannot be adapted to an existing steam station in the simple way that a turbine can be put down in a reciprocating-engine station. It involves a radical change of method.

If internal-combustion engines have an inherent and absolute superiority over steam engines, they will ultimately come into extensive use and will take their proper place even in municipal stations; but the process of change, especially at the present stage, must be a slow one. Diesel engines, in particular, have of late made remarkable progress, and it is certain that no one building a new generating station of moderate power is, at the present day, justified in neglecting the very serious consideration of them. We hardly think the large gas engine can be said to have yet attained a similar position. In the mere matter of capital expenditure, for instance, there is not enough extended experience available for any generally accepted figures to be extant. —*Engineering.*

Central Station Conditions in Sioux Falls Improved.

By taking over the management of the Sioux Falls Electric Light & Power Company and the Sioux Falls Light & Power Company, which transaction has recently been consummated, H. M. Byllesby & Company, Chicago, has relieved a situation which has seriously threatened the welfare of the public and utility business in Sioux Falls, S. D.

The two lighting companies, until becoming a part of the Byllesby organization, have been arch competitors with the resultant bad effects that follow competition in this field of endeavor.

The consolidated company will be known by the corporate name of Sioux Falls Light & Power Company. One of the first acts of the new local manager, N. C. Draper, was to reduce the base rate of energy from 20 to 11 cents per kilowatt-hour.

Long Beach Station Starts Up.

The big Long Beach steam plant of the Southern California Edison Company, which was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for April 8, 1911, has been put into service.

The opening of this plant brings to the front the fact that the Edison Company is facing the most peculiar problem in Southern California in that the demand for power is rapidly outgrowing that for lighting and the operating report of the company shows that during the month of May last this increase in power business was remarkable.

Since 1904 the power business has been gradually gaining upon the light business, notwithstanding the enormous increase of the latter, which grew 128 per cent during the period of 1904 to 1910. During the month of May power showed an earning of $4,771.95 in excess of lighting.

In spite of the competition of the municipally owned Owens River aqueduct, power and electrical companies in this section are this year spending something like eight million dollars in the development of steam auxiliary plants. The answer is to be found in the fact that the officers of the private electric companies have learned by experience that service depending entirely upon water-power generation is unreliable to the extent that it is subject to the destructive forces of floods and washouts, and that long transmission lines are menaced by many forms of interruption. It logically follows that in a possible contest for business, the system which can guarantee the merchants and manufacturers that their stores will be lighted and the wheels of their industries supplied with power, will have the advantage over the unreinforced water-power system.

Provision for a distributing electrical system in Los Angeles is being worked out by the Public Service Commission, and it has called on E. F. Scattergood, head of the Power Bureau, to furnish all his data and estimates in reference to the cost of such a system. Mr. Scattergood is expected to file his report in about two weeks.

If the system is to be constructed it may take two years to complete it and a bond issue of practically $4,000,000 to pay for it. The city might save time by acquiring, through condemnation or purchase, the distributing system of one of the corporations. It is on these points that it asks Mr. Scattergood for his data.

Last fall Mr. Scattergood estimated that a complete distributing system over the entire city, with an enlarged area for the underground conduits would cost $4,250,000.

The distribution question has been revived by the report of the city electrician that no contracts for public lighting may be made with the present companies until they know what the city is to do, and by the decision of the Board of Public Works as to the first power service it will provide.

Conservation of Water Power.

Investigations of possible sites for developing water power on the public domain are being pushed by the United States Geological Survey, with resulting withdrawals of land from entry where it is found that valuable sites exist. In July 31,725 acres of such land were withdrawn, including a great number of power sites. No estimate has been made of the horsepower involved, but owing to the character of the power sites withdrawn it is believed to be extremely large.

The July withdrawals make a total outstanding area withdrawn of 1,546,258 acres, based on the examination and recommendation of the Geological Survey, and involving thousands of power sites and doubtless millions of horsepower. The withdrawals are made in aid of proposed legislation by Congress which shall provide for the fullest possible development of these enormously valuable properties and at the same time guard the public interest.

Pennsylvania Coal.

Except that of the "boom" year, 1907, the production of anthracite in Pennsylvania in 1910 was the largest in the history of the industry, according to E. W. Parker, coal statistician of the United States Geological Survey. The quantity produced in 1910 was 75,433,346 long tons, an increase over 1909 of 3,058,997 long tons, the value increasing from $149,415,847 in 1909 to $160,275,302 in 1910. The production in 1910 was within almost exactly 1,000,000 long tons of the maximum record for 1907, when the output amounted to 76,432,421 long tons.

Electric Lighting and Illuminating Engineering

MISCELLANEOUS LAMP CHARACTERISTICS.[1]—I.

BY M. TAPPLEY.

The present notes are in no sense or degree intended as a complete survey of lamp characteristics, but merely comprise a collection of miscellaneous data and facts collected from many sources, during a number of years. The lamps dealt with are mainly electric, though other types are referred to from time to time.

Types of Luminous Sources Available.—It is hardly necessary to explain at length the desirability, from the efficiency standpoint, of a "cold" source of light; all heat generated by a luminous source, and stored or radiated at a lower temperature than that at which incandescence commences (700 to 800 degrees Fahrenheit), must be regarded as energy wholly wasted so far as the primary object of the source is concerned. What is theoretically desirable is a source emitting light without heat, and in such a case alone is 100 per cent luminous efficiency even theoretically possible.

The vast majority of commercially successful lamps depend upon incandescence for their luminosity, and it then becomes necessary to operate at as *high* a temperature as possible, in order to increase the ratio of the luminous to the invisible radiations.

Thus, while ideal conditions require a low temperature, it is usually necessary in practice to go as far as possible in the opposite direction, owing to the impossibility of realizing the theoretical desideratum—in other words, instead of *reducing the heat* emissions we must strain every endeavour to *increase the luminous* radiations.

The "cold" light of fluorescence and phosphorescence cannot be utilized commercially, owing to its weakness and inconstant nature. Some attempt has, it is true, been made to utilize such a "cold" light in the transforming reflectors used to correct the illumination of mercury arcs and similar monochromatic or strongly colored sources. Such reflectors, when for use with mercury arcs, are coated with a varnish in which rhodamine is the essential constituent; collodion is used to "carry" an alcoholic solution of rhodamine, a little castor oil being added to promote subsequent fluorescence of the coating.

A somewhat similar luminous source (again of a secondary character) may be obtained by using a solution of pyrogallol and formaldehyde with thirty per cent hydrogen peroxide. This solution emits a comparatively strong red light, while remaining cool enough to be easily handled.

Cold sources such as the above are, at present, of little more than academic or laboratory interest, and the most hopeful means of approaching ideal conditions in a *commercial* lamp seems to be by utilizing the luminescence of gases traversed by an electric current. Thus the Moore vapor lamp, employing the principle of the Geissler tube by passing a high-tension electric discharge through nitrogen or carbon dioxide at a pressure of about one-tenth millimeter is a comparatively cool source, though its temperature is still too high to enable it to attain very high efficiencies by reason of this characteristic. Similarly, the Cooper Hewitt lamp, employing the luminescence of mercury vapor, runs at 300 to 400 degrees centigrade, a temperature which, though comparatively low, is high enough to preclude any abnormal efficiency due to coolness of the source.

In short, no commercial source of illumination is really *cool*, and it almost invariably pays, therefore, to *increase* the working temperature of the source as far as possible in order that the increased incandescence, outweighing its own heat-radiation increment, may contribute something to the reduction of the *relative* importance of the remaining thermal radiations. Thus the quartz mercury-vapor lamp owes its great advance in efficiency over the ordinary mercury lamp to the much higher working temperature which is possible in the quartz tubes employed.

Whereas the vapor temperature in the Cooper Hewitt lamp is probably well under 500 degrees centigrade, that in the quartz type is said to approach 6,000 degrees centigrade in the central core of the vapor column (probably the actual temperature, though still very high, is considerably lower than this abnormal figure).

Most flame (combustion) lamps derive their luminosity from incandescent carbon particles, formed and consumed in the flame, while later and more efficient sources (other than electric) depend chiefly upon the introduction of refractory solid bodies (*e.g.*, lime or rare-earth "mantles") into an intensely hot non-luminous flame. In electric lamps, besides the luminescent-vapor types, we have the incandescent filament (of carbon, rare earths or rare metals), and the arc struck between solid electrodes—whether of pure carbon, impregnated carbon or magnetite or similar novel composition.

Failing the commercial feasibility, or pending the realization, of a "cold" source, what is required is a refractory substance which will *radiate as light a maximum percentage of the energy supplied to it.* The development of rare-earth and metallic-filament glow lamps is typical of the utilization of substances of very high working temperature,[2] also fortunately possessed of the property of radiating selectively to a certain limited extent. By "selective" radiation is meant energy radiation in quantities of various wave-lengths other than would be radiated by a "black" body under similar circumstances. What is required in incandescent lamps is a selective radiator which will, at a certain temperature, radiate a greater percentage of luminous energy than is accounted for solely by its temperature (taking a "black body" as standard). Though

1 Abstracted from the *Electrical Review*, London, July 21 and 28, 1911.

2. Carbon melts at a far higher temperature than the metals used in glow-lamp manufacture (tantalum, tungsten, etc.), but the latter can be worked at a temperature 200 to 400 degrees centigrade higher than that at which carbon filaments commence to disintegrate.

"cold" radiation is, at present, inapplicable to commercial high-candlepower lamps, we may yet, by aid of selective radiation, approach efficiencies otherwise unattainable.

When it is remembered that a black body at about 12,000 degrees Fahrenheit would radiate only fifty per cent of its total energy as light, and that the theoretical mechanical equivalent of luminous radiations is about 0.08 watt per candlepower, it will be seen how limited is the efficiency which can be attained by any incandescent source of light and how far even the best of modern lamps falls short of the efficiency theoretically obtainable.

Rating of Lamps.—The rating of lamps—the denomination by which their capacity, and hence their illuminating and commercial value shall be judged—is not a particularly difficult problem in the case of electric lamps other than arcs. Old-fashioned lamps (flame lamps, etc.) were, and are, seldom given any particular rating, but their performance is tolerably uniform[3] whatever the make of lamp, and is so familiar, in a rough way, that no precise rating is necessary. When electric glow lamps and improved gas burners began to be placed upon the market, however, the necessity was felt for devising a definite rating system, if only to enable a graphic description of the merits of the new forms of lamp.

Gas burners and mantles are usually rated by the candlepower they yield when new and consuming so many cubic feet of gas per hour; such a rating is of fairly permanent value in the case of gas burners, but (as shown later) gas mantles undergo a rapid deterioration which necessitates a liberal reduction from the nominal rating in order to determine the mean useful candlepower during the life of the mantle. Similarly, the rating applied to glow lamps of various types is based upon their candlepower when new and operated upon the supply voltage for which they were designed. In the case of carbon-filament lamps, the deterioration in candlepower, which occurs before the "smashing" point is reached, may be twenty per cent, hence the nominal rating again requires correction in order to yield the mean effective candlepower. In the case of metallic-filament lamps the deterioration is much less rapid and less in total amount; hence correction therefor is proportionately less important.

The question at once arises as to how the "rating" candlepower should be determined. In the early days of electric lighting, when simple filaments were common, it was usual to follow out a gas-engineering convention by photometering the lamps with the plane of the filament at forty-five degrees to the length of the photometer bench. The candlepower thus estimated was a reasonable and sufficient rating basis for those days, but the complex filament shapes now employed, and the greater accuracy of working needed to discriminate between various lamps, call for a more satisfactory and widely applicable rating. Though mean spherical candlepower would be the fairest basis of comparison (as being proportional to the total luminous flux from the lamp), mean horizontal candlepower is usually accepted for glow lamps, mainly because this quantity is readily determined, and with considerable accuracy, by taking readings in a few radial directions in a horizontal central plane through the lamp. Mean hemispherical candlepower is hardly a suitable rating for glow lamps, since these are generally employed in rooms and similar spaces where upward-going light is of very distinct value. If a glow lamp is to be used with an opaque top reflector, or applied to street lighting, mean hemispherical candlepower (as determined when completely fitted for service) is, of course, a very suitable rating.

The rating of tube lamps presents difficulty only in the great and distributed extent of the luminous area; a mean hemispherical candlepower rating is most convenient for these lamps as at present utilized, and the candlepower per foot (taking the average value for a full-sized lamp) is a useful basis for estimating purposes.

In carbon and flame arcs, however, wholly different conditions are met. The main difficulty is that the candlepower is constant neither in maximum nor mean value nor in distribution; the rapidity of its variation in every respect is so great that it is with extreme difficulty that any consistent arc-lamp observations can be made. It naturally follows that extraordinarily high candlepowers may be *momentarily* observed during tests on any arc, and, in the early days of arc-lamp development, makers carefully sought after these "snatch" readings, and, obtaining from them extraordinary efficiencies, promptly adopted the latter as the basis of their standard lamp ratings. These, correct and legitimate so far as they went, were, like the data on which they were based, "snatch" ratings, and the fictitious significance attached to them led to the development of what was practically an arbitrary system of rating. Thus for a number of years a "2,000-candlepower" arc lamp consumed 400 to 500 watts, and was really of about 750 mean hemispherical candlepower. Such a state of affairs naturally caused much confusion, not to say deception, and it is fortunate that makers and consumers alike now realize the advisability of a straightforward rating, based on mean spherical candlepower or mean hemispherical candlepower, *measured under normal and definitely stated conditions.* The necessity for the italicized clause will be apparent from the following data. A certain Westinghouse-Bremer flame arc gave efficiencies:

	With globe.	Without globe.
Watts per maximum candle power..	0.180	0.081
Mean hemispherical candlepower....	0.287	0.133

The possibility of accidental misunderstanding or wilful misrepresentations of these figures, were the conditions of their application not definitely stated, needs no explanation.

Mean hemispherical candlepower is a convenient and usual rating for most arc lamps since the commonest application of the latter is to street lighting and similar duties, in which any light leaving the complete lamp (including its globe and reflector fittings) in an upward direction is useless. Otherwise the mean spherical candlepower is the rating to be employed; the candlepower in any individual direction is of no real value, though the *maximum* candlepower of an arc is often cited (it is, alone, of no value, but is an interesting figure and one which forms a useful "catch" number for advertising purposes).

(To be continued.)

3—At least there is nothing comparable to the vast difference in efficiency which may exist between outwardly identical electric lamps; and differences in the grade of oil used in paraffin lamps, say, are less important than changes in the brand of carbons used in arc lamps.

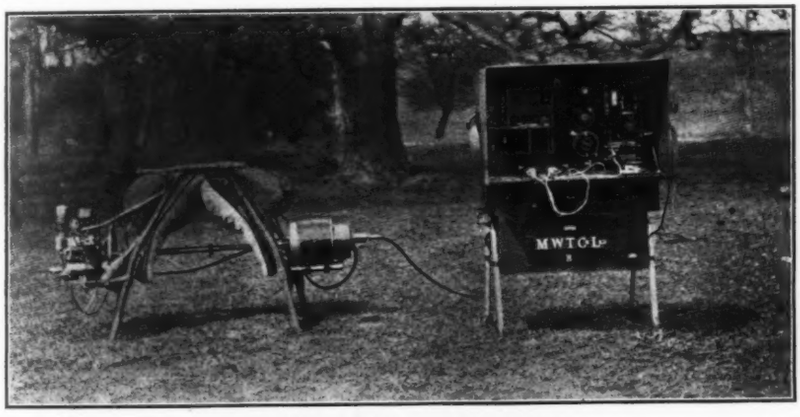
Electric Lighting in European Capitals.

Figures recently given by an authority on electric lighting in Russia show that St. Petersburg, Russia, has the best lighting *per capita*; there being 440 sixteen-candlepower lamps per 1,000 population.

Telephony · Telegraphy and Wireless

Progress in Wireless Telegraphy.

In a lecture delivered at the Royal Institution in London early in the summer under the title "Practical Progress in Wireless Telegraphy," T. Thorne Baker, reviewed the recent advances in this domain of applied science. He referred to the type-setting machine of Hans Knudsen, which was actuated by electric waves, and to the adaptation of the Duddell oscillograph to the production of records of radiotelegraphic signals. A silver-quartz fiber was stretched across the field of a powerful electromagnet, and its image cast upon a screen; the arriving oscillations passed first through a Fleming valve detector, in which they were rectified, and then through the fiber which they displaced, thus opening the shutter of a slit, in front of which a lamp was placed, while a photographic film was moved behind it. The slit could also illuminate a selenium cell, and thus actuate a receiving marker. At Clifden, an Einthoven galvanometer with silvered-quartz thread was used for the purpose of photographing the waves received from Glace Bay, 2,200 miles distant.



MARCONI FIELD WIRELESS SET.

He described in detail the cavalry field wireless-telegraphy set of the Marconi Company, which was divided into four lots, each carried by one horse; it weighed, with 2 gallons of gasoline and lubricating oil, 600 or 700 pounds, and would work well over distances of thirty miles. The spark was produced by a transformer fed by an inclosed water-tight four-pole dynamo, driven by a gasoline motor through a telescopic shaft, consisting of two square tubes sliding in one another. Motor and generator were attached to different sides of the saddle, the shaft being under the body of the horse. The motor was made of aluminum, and was cooled by a fan, and started easily by a turn of the handle. The spark-gap was provided with a shunt comprising a condenser in the form of a vibration-proof battery of Leiden jars, and the primary coil of an oscillation transformer. Three selective amounts of winding were available, both on the primary and secondary, and switched in to alter the wave-length. One end of the secondary was joined through an earth spark-gap to an earth-net of phosphor-bronze gauze, two feet wide and twenty-five feet long, which formed a counter capacity to the aerial, and could be quickly rolled out. The receiving apparatus was fitted with a reciprocating three-way tuner; the receiver could at once, during a conversation, be adapted to the changed wave-length transmitted, so as to render "tapping" very difficult. The transmitter required only a fairly sharp tuning, provided the receiver were capable of very sharp tuning. The set included a stand and a canvas cover for it, as well as a lamp and an accumultor. The two masts, thirty feet high, were made up of six hexagonal telescopic tubes; they were fixed 375 feet apart to support the aerial. Fleming's valve receivers were used.

Speaking of communication with airships, Mr. Baker pointed out that a long trailing aerial was almost out of the question on aeroplanes, and a network of electric wires on the aeroplane was exceedingly dangerous to the pilot, whom an electric shock might momentarily disconcert. Farman had used two trailing wires, each 100 meters in length. Baker himself had not used loose wires, but attached fifty feet of wire to the machine itself, a Bristol biplane, fixed round the frame of the biplane, but carefully insulated from the network of steel wire. In his recent experiments he had been using a six-inch induction-coil with a five-eighth-inch spark-gap, as far removed from the gasoline tank as possible. In a new arrangement which he and Lorraine were trying, a long light brass tube was attached to the one side of the tail of the aeroplane (insulated from it) to serve as counter capacity or earth for the aerial on the other side, which ended in sixty feet of wire trailing behind.

As regards the very important possibility of receiving messages on aeroplanes, telephone receivers could not be used on account of the noise of the motor, on whose working the pilot had to concentrate his attention, as it meant life or death to him. Visible signals had to be resorted to. With the help of a coherer, a local battery and relay, and, further, of a decoherer (worked by clockwork and a magnet), which tapped the coherer every two seconds, a lamp could be lighted by the arriving waves, and the lighting was maintained for one second when a dot was to be signaled, and for two seconds when a dash was to be transmitted. The decohering could not be left to the unavoidable vibrations of the aeroplane, but had to be independent. Unfortunately, the vibrations produced by a "Gnome" seven-cylinder engine, travelling at thirty miles per hour, were so rapid that the coherer would not act. In such cases anti-vibration holders would have to be employed, or some coherer like that of Brown, which was insensitive to shocks.

On airships matters were less difficult. The apparatus carried by the Beta mi-

litary airship weighed about 100 pounds, and signals had been conveyed on favorable occasions to a distance of 50 miles. The apparatus consisted of an ordinary induction-coil, an accumulator, one trailing wire, and a counter-capacity. The equilibrator of the Wellman airship would offer the advantage that it maintained metallic connection with the sea-water, while in ordinary balloon work the wave-length of the oscillations varied greatly with the height above the earth, owing to the difference in the capacity of the aerials relative to the earth.

Mr. Baker showed a small receiving set, to be carried in the knapsack, which he had recently submitted to the Army wireless department. Everything necessary for detecting oscillations and for tuning was contained in a box slightly bigger than a cigar-box. The aerial (a wire suspended from a tree or a portable mast) and the earth connection were joined to the ends of the primary of a small oscillation transformer, consisting of fine wire wound on an ebonite tube, over which the secondary could slide.

The limiting factor in this apparatus was the detector. Valve detectors and electrolytic detectors, otherwise good, were heavy or delicate, and crystal detectors (silicon, borite, and carborundum) mounted in a suitable holder appeared preferable. The crystal was placed between two brass drums, one of which was fixed in the bottom of a glass tube of the same diameter at the drum; the top drum came down upon the crystal, and the pressure was regulated by means of a small micrometer screw.

The direction from which a message came could be determined by means of a "wireless compass," of which various types had been devised. In the complex antenna, which required ample space, wires were suspended radially and joined, one after the other, or one pair after the other, to the receiver. De Forest used a grid which was turned until it gave the loudest signal when broadside on. Baker himself had been obliged, owing to the strongly directive effect of aeroplane transmitters, to use two sets of aerials at right angles to one another, and now made use of a triple aerial, 150 feet long, suspended from a mast 36 feet high. Bellini and Tosi use as a receiver their radiogoniometer, consisting of two closed oscillating circuits connected with the aerials, these being triangular in shape, vertically placed and mutually perpendicular; the emission from these aerials was compounded with the circular emission from a plain aerial. A movable coil was so arranged that the action of the directive aerial would either add itself to that of the vertical antenna or subtract itself from it. More power would, however, be wanted for these directive devices, and it might be possible to deflect the path of the oscillations from two aerials by means of a magnetic field.

A new arrangement of Mr. Baker's for giving a rapid train of damped oscillations consisted of a geared wheel set with radial spark-rods; each time a radial rod came in contact with a fixed rod, a Leyden jar was shunted through the induction coil across the spark-gap; there were as many jars as radial rods, and a commutator and a high-frequency brush closed the circuits.

One of the primary functions of directive systems was to prevent the interception or tapping of messages. Captain Hovland, of the Norwegian navy, has devised a very ingenious instrument for secret military work. He replaced the Morse key by a typewriter; each depressed letter made contact for a corresponding cipher, and the actual cipher could be changed at will, there being as many as 720 possible combinations; the messages were printed at the receiving station.

Baron Lepel's musical bugle-calls were another noteworthy novelty which had been tested between Brussels and Slough. When a spark-gap was shunted with heavy capacity, groups of disturbances were produced, giving rise to a musical note which was more easy to pick up than unmusical signals. Lepel produced the eight notes of an octave with the aid of a keyboard switch for the transmission of bugle-calls or musical code tunes.

Mr. Baker then referred to one of the most useful advances in wireless work —the telephone of A. W. Sharman, which had given excellent results in the coal-mines of Newcastle. The small apparatus, weighing seven pounds, was fixed on a tripod like a camera. It contained a low-resistance impulse coil, a key, and battery; two wires ran from the coil to steel pegs (rods with handles) stuck into the ground, about fifty feet apart.

The impulse coil embraced an iron core, and the circuit was interrupted when the core was magnetized to saturation, so that the lines of force collapsed suddenly. The impulses travelled outward as elliptical waves, not superficially only, but like spherical pulsations. On land two miles could be covered with a primary energy of four watts, and better results still—a range of six miles with sixteen watts—had been obtained in water between ships and submarines. The distance to which systems could be worked, would depend upon the primary energy, and still more upon the proportion of the energy which could effectively be controlled by the microphone or other variable element in the receiver; currents of more than 1.5 amperes would cause heating and arcing in the microphone, and thus limit the range practically to about five miles. The high efficiency of the Sharman system was due to the fact that earth conduction was utilized in addition to induction.

Concluding, the lecturer explained the remarkable possibilities of the system of Mr. Habibia, an Indian telegraph overseer. He utilized the surface of water (rivers), instead of the ether, and earth connections, and was able to send messages over distances of fifty miles with the energy of a small medical coil; the one-wire antenna lay on the surface of the river.

To Ferry Across the Ohio.

General Manager Carson, of the Evansville, Henderson & Owensburg Traction Company, has worked out an economical, swift and reliable plan to ferry the traction cars bodily over the Ohio River, between Evansville, Ind., and Henderson, Ky. W. M. Whitaker, naval architect, of New York, is now drawing plans and specifications for a twin-screw steel-hull ferry boat to be built under rush order. This boat is to be 130 feet long and capable of transporting two fifty-foot interurban cars over the river. It will be run by two gasoline engines, each of sixty horsepower.

Mr. Whitaker is also planning the sliding cradles, which will allow the cars to be run off and on the boat during any stage of water.

It is estimated that five minutes will be required to take a car or train across the river, which is only 1,600 feet at the incline. Thirty minutes will be required to take a car over the land rails. At present the quickest time made by steam line or boat is one hour.

Industrial Power

ELECTRIC TRACTION IN SWITZERLAND.[1]

BY E. HUBER-STOCKAR.

Electric traction on railways has occupied the minds of scientists and inventors as far back as the times of Faraday's memorable and fundamental discovery of the electromagnetic mechanical production of electric current. In those times Davidson experimented with an electric locomotive on the railway between Glasgow and Edinburgh. His locomotive weighed about five tons; it had two axles, each driven by an electromagnetic machine, and current was supplied from two Sturgeon's primary batteries carried on the locomotive. It was one of those unsuccessful but historically necessary attempts of science applied to practice prematurely.

It took about fifty years to make the electrical machine a thing really worthy of this designation, the signification of which was always determined by the high state of the art of mechanical engineering in general at the particular time being. The decided and increasingly rapid development of electric locomotion began not much later than that of electric lighting, but earlier than that of electric power transmission proper. The key to electric traction was the self-adjusting trolley running underneath a contact wire suspended overhead. The necessary requisites in shape of electrical machinery of sufficient voltage and power of the so-called working in parallel or constant-voltage distribution and of a certain practical experience in electrotechnics were already in existence some time previously. After the start was made with the practical application of electricity to locomotion on rails shortly after 1880, electric traction has developed along the lines of technical possibilities and actual demands, a good deal of which were modified or created by the very possibilities inherent to electricity as applied to traction.

In the large cities, elevated, underground and tube railways were equipped electrically. In Switzerland mountainous districts, inaccessible to steam traction, came in possession of efficient railways invaluable for their commercial and touring development.

Electric railways proved to be an economic possibility where steam railways could no longer be financed. Especially in Switzerland, where living and manufacturing had become very expensive in the large towns, electric railways opened up agricultural and out-of-the-way districts for commercial enterprise, and furnished a system of communication by rail, thus completing and feeding the system of main-line railways in a most beneficial manner.

Since 1890 electric traction has been adopted on one or another section of railway where steam traction appeared suitable. Subsequently, however, and more particularly since the beginning of this century, the question arose whether electric traction would not be the proper method of operating railways altogether, and it was, for a certain time, a matter for discussion whether the steam locomotive was to disappear and to be superseded by the electric locomotive and motor-car.

Today the question is put in a restricted and more definite manner, and is treated with more recognition and knowledge from the part both of the electrical engineer and the railway manager. The one is realizing more fully the enormous responsibility of the service of the railways he wished to electrify, the other is recognizing more appropiately the reliability and efficiency of electric traction.

At the present time a number of remarkable electrifications have been carried out or are in course of completion, so that it is not necessary to waste words in justifying railway electrification. At any rate, railway electrification will furnish work to a number of branches of mechanical engineering. More particularly the locomotive builder need not fear being deprived of work. His co-operation with the electrical engineer has been most significant and useful until now, and will be so in future. The era of motors geared to driving axles as in street cars has probably passed as far as the more powerful vehicles are concerned, and the electric locomotive of today is, with regard to its mechanical part, to a large extent the work of the steam-locomotive builder.

The reason for dealing more particularly with railway electrification in Switzerland is not because greater progress has been made in this direction, but because of the more general interest it presents in comparison with many other countries.

First of all, it may be found astonishing that progress has not been greater in this country than it actually has been, when one considers that Switzerland has to buy all its coal from foreign countries and has a large amount of water power still waiting for utilization.

Secondly, Switzerland has had certain railways electrified at a comparatively early date, and may be expected to have gone onward on this basis, especially as applied electricity is highly developed in the country generally.

Thirdly, the very reason of the progress being less than may be expected adds greatly to the interest of the problem as presented in Switzerland. There are no such sections of railways as the terminal section of the New York Central & Hudson River and the New York, New Haven & Hartford railways, where steam has played out its rôle on account of the frequency of the trains or the smoke nuisance, and no such sections as the London Bridge and Victoria of the London, Brighton & South Coast Railway, where over a million passengers were to be recovered that had been better served by competing tube and street railways. Though railway electrification in Switzerland is inseparable from the use of water power, and though this use is evidently beneficial to the financial situation of the country in the long run, still it must, for various reasons, be done in a way so as not to disturb the balance of traffic receipts on the one hand and the operating expenses and interests on loans on the other. The time is still far distant where even state railways are built, as the principal street

[1] Abstract of a paper presented before the (British) Institution of Electrical Engineers at its Zürich meeting.

roads have been built all through the country and over the mountain passes, simply because they are necessary, no matter whether they are remunerative or not. Railways are still built and operated for the greater part, and most fortunately so, even by the state, on the basis of a commercial enterprise conducting a household of its own. Therefore more particularly in Switzerland, where railways are, on the whole, not making profits because of cost of construction, heavy grades, rather irregular traffic, short average distance of travel, high wages, low fares and so on, the problem of railway electrification is in every case a problem mainly of general economics of railway operation, since the technical problem has admittedly been satisfactorily solved by far.

The electrifications of importance that have hitherto been or are being carried out are almost all either of an experimental or preparatory character, or were brought about by considerations not directly or purely economical. In Switzerland the economy of operation is having a decisive weight and makes the problem, as it is presented, difficult.

In Switzerland, as in other countries, the railways already electrified or about to be electrified in the near future are such that the smoke nuisance would be an almost prohibitive feature of steam, as in the case of the Simplon tunnel, or where the capabilities of steam are near exhaustion, as in the case of the St. Gothard railway.

To prevent misunderstanding it is expressly stated that by railway electrification is meant the introduction of electric traction either on existing steam railways or on such new rails that would or could on account of their general character of road and traffic, and by analogy with similar existing steam railways, be operated by steam. By railway is meant simply a line or system of lines of railway comparable with a steam railway line or system of lines of medium or great importance. This involves a somewhat high standard of construction, of passenger and freight trains, of a certain weight and frequency, a traffic of a certain volume, and of a service of high responsibility. It excludes railway lines of a purely local character and smaller importance as links of the whole system of railways of the country; it excludes street railways of the character of tramways, whether urban or interurban; it also excludes railways of a special character, such as rack and rope railways or railways operated during a part of the year only, even if their kilometric traffic or their local or tourist interest be great.

The gauge of the track, however, is not a feature which decides whether a railway does or does not belong to those which are comprised in the railway electrification problem. There are, in Switzerland, only two gauges to be considered. There are normal-gauge interurban and branch lines similar to tramways, playing no rôle in the electrification problem, except as experiments, and there are narrow-gauge railways that are important in their district and in general, and run trains of a weight exceeding that of many normal-gauge steam railways. These narrow-gauge railways must be included in the problem.

Space does not allow one to deal with all those narrow-gauge railways, with one exception, that had or have a significance in the evolution of electric traction on railways. Among these railways are notably the Montreux-Oberland Bernois and the Bernina railways, both of considerable length, which demonstrate possibilities of railway construction and operation far beyond what can be done on the basis of steam traction. There are among those also the Locarno-Bignasco and the Bellinzona-Mesocco railways, which are representative of types of railways and electric equipments capable of extension on to lines and systems of lines of great importance.

BURGDORF-THUN RAILWAY.

It is noteworthy that the first electric traction on a railway of the general character of normal-gauge railways of medium importance was on the alternating-current principle and more particularly on that of three-phase current. At the time of construction of the Burgdorf-Thun Railway, three-phase current was almost universally used for all power transmission and distribution dealing with distances of some importance. The supply of electric power to the trains of the road, the terminal of which is Burgdorf, is over thirty-one miles distant from the source. Owing to the length of railway and with the means then available, sectionizing of the line was obviously necessary, 500 to 750 volts being then still the limit of electric-traction voltage considered necessary, and substations were also required. According to the practice, at least two such substations with converting machinery under constant attention would have been necessary. The trains likely to be hauled were of a weight, and the grades of a length, not yet customary in electric-traction practice in general; those substations would have become of a size and cost both of plant and operation not compatible with the small average useful load of the few trains on them.

The solution of the problem in an economical way, as regards cost of plant and specialty of operation, was obviously the elimination of costly substations and the adoption of the three-phase current transmitted from the power house to the contact line and traction motor equipments instead of first to converter stations.

The essential feature of all alternating-current methods is the possibility of transforming current of high or low voltage into current of low or high voltage with relatively little loss of power in apparatus relatively cheap, having no moving parts and requiring only occasional attention.

The credit of having introduced three-phase current for electric locomotion on railways is largely due to Brown, Boveri & Company, Baden. The scheme was not entirely novel, as the same firm had already equipped a few kilometers and cars of the tramway in Lugano, the Gornergrat rack railway and the Stansstad-Engelberg railway. The adoption of three-phase current involved a compromise of advantages and disadvantages which are more or less evident. The advantages were: the elimination of costly substations and the reduction in investment or in the loss of power, or both, by making more sections of smaller length, supplying each with a simple transformer substation, the aggregate cost of which was far below that of even a much smaller number of converting substations.

The disadvantages, on the other hand, were: a more complicated contact line composed of two contact wires that were to be interinsulated, certain difficulties in the construction and operation of the contact line above points and crossings of track, the impossibility of increasing, by whatever means of controlling apparatus, the speed above a certain constant speed, which had to be accepted as the normal speed on load, also working at lower speeds being connected with considerable loss of power in the form of heat. That speed depends on the fixed and constant number of periodic cycles of any kind of alternating current and the unalterable number of poles of the motors. The motor runs almost as if

it was positively geared to the machines in the power station. Consequently the speed of a train remains practically constant on all up-grades as long as the electric current is on, and the torque of the traction motors required corresponding to the resistance of the whole train keeps within certain limits, beyond which the motors get "out of step" and stop. This feature has, however, not been felt as a source of trouble, and will not be so felt if motor equipments and train loads are properly proportioned, as they must no less be in steam practice.

The Burgdorf-Thun Railway was electrically equipped from the beginning. It is operated by the Emmentalbahn Company, also operating a steam line between Solothurn and Langnau. About four miles of track east of Burgdorf are common to both railways and are therefore operated by steam and electricity at the same time.

From the beginning there were two locomotives for dealing with freight trains of 100 to 150-tons weight. These could operate with two different ratios of gearing, the one or the other gearing being clutched in. The one-speed feature is thus overcome to a certain extent. The locomotive can run economically at two speeds, 16 and 11 miles an hour, while the one-speed feature is reserved for each of these two particular speeds.

In 1910 another locomotive, of a type first introduced in the Simplon tunnel, was added, which allows much heavier trains to be hauled. Instead of purely mechanical means of overcoming the one-speed inconvenience, not desirable in heavier traction, purely electrical means were adopted. The multi-speed feature, adopted and developed for other purposes than traction proper many years before, was resorted to and adapted in a way so as to specially suit the case. By means of a controller switch, sectionizing the windings of the motors, these are made, in the case of these locomotives, of one out of four different numbers of poles. Consequently the motors run, according to the number of their poles, by virtue of the position of the switching controller, at one of those particular speeds. It is seen that there are four different motors incorporated in one motor, properly called a multi-speed motor. With reference to each of these four speeds the one-speed and the gear-wheel features obtain, there is, as experience seems to prove, yet a sufficient freedom of adjustment of the economical speeds to the varying requirements of practical locomotive driving on the railways having such locomotives.

The electric traction on the Burgdorf-Thun Railway has been satisfactory. Disturbances interfering with traffic have practically disappeared, and at no time has any dissatisfaction been noticed. It is of the greatest benefit to the electrical operation, especially since a powerful locomotive has been added, that power is supplied from a large power station near Spiez on the Lake of Thun, capable of dealing with the heavy variations in load. The power station belongs to a large power transmission and distribution supply enterprise. The transmission voltage between Spiez and the fourteen transformer substations along the railway is 16,000. The consumption of electrical energy is sixty-eight watt-hours per ton-kilometer.

FREIBURG-MURTEN-INS RAILWAY.

The Freiburg-Murten-Ins Railway is interesting as the first normal-gauge railway which has undergone actual electrification. This railway is of invaluable service to the district traversed, but the financial results are unsatisfactory. The electrification was made possible by the controlling influence and financial interest of the State of Freiburg both in the railway and in the electric power-supply enterprise. The electrification was completed in 1902 as far as Murten, in 1903 on the extension to Ins only then constructed. There are only four motor cars. Locomotives will come if freight traffic becomes sufficiently developed.

This electrification was the first and is the only normal-gauge one in Switzerland carried out on the continuous-current system with a third rail. The pressure of 800 volts was a novelty in third-rail practice at that time, and has proved safe and satisfactory.

Three-phase current of 8,600-volt pressure and fifty cycles is supplied from Hautersive, a hydroelectric station of 10,000 horsepower distributed for all kinds of purposes in the district. The third rail is fed from two converter stations, each equipped with converting machinery of relatively moderate size and accumulator batteries to provide for peak loads.

The consumption of power is about thirty-four watt-hours per ton-kilometer, exclusive of losses in converting machinery and batteries. Inclusive of these losses the consumption is to be estimated at 60 to 80 watt-hours, according to circumstances.

SEETHALBAHN RAILWAY.

The Seethalbahn Railway is of an exceptional character, as it appears really to be a normal-gauge street railway of considerable length and traffic of both kinds.

The electrification at present completed is an actual one with regard to the steam operation having reached an age of thirty-seven years. The very fact of so large a portion of the track being laid on public roads and the main streets of a number of villages has, aside from the heavy grades of a section more recently added, brought about the abolition of steam in favor of electricity. Steam traction could not keep pace with the development of the districts traversed and appeared to be incapable of securing to the railway that share of through traffic to which it can be considered entitled with regard to its terminating in a center like Luzern on the one end and at Wildegg, a station of the main line Brugg-Olten, on the other end.

In fact, the Seethalbahn is a regular normal-gauge railway with a great length constructed on large public roads which are used chiefly for agricultural traffic. It must, therefore, be considered quite apart from the particular interest it presents, as a normal-gauge single-phase alternating-current electrification of considerable magnitude.

Power is obtained from the power station at Beznau, of the Beznau-Löntschwerk, by transmission of 1,000 to 2,000 horsepower in the shape of three-phase current at 8,000 volts and a periodicity of fifty cycles. In one substation at Beinwil, not far from the middle of the line, this three-phase current is converted by machinery into single-phase current of 5,000-volt pressure and a periodicity of twenty-five, fed directly into the overhead contact line without any intermediate transformer substations.

There will be run in both directions twenty pasenger trains of sixty-seven tons (stopping at way-side stations) and seventy-four tons (faster), besides four freight trains of 162 tons total weight. On sections on public roads the speed of passenger trains will be sixteen on private tracks and twenty-eight miles per hour. The speed of freight trains will be sixteen miles per hour throughout, except on the maximum grade. All trains are moved by one motor car each. Multiple-unit control is, however, provided, and heavier trains thus made practicable.

As trains of more considerable weight are not expected, electric locomotives

have not appeared desirable apart from a little electric shunting engine at Hochdorf station. It is, however, evident that at any time a service of locomotives and heavier trains can be organized by the addition of electric locomotives without changing the nature of the operation of the railway in its appearance.

The electric service of the Seethalbahn may be considered representative of the local and suburban service of principal railways, which, while operating trains of any weight for long-distance traffic with powerful locomotives, organize their local and less heavy suburban traffic with motor-car trains or even single motor cars of the type similar to that of the Seethalbahn. The voltage of 5,000 on the contact line would, according to present knowledge, not be adopted in the case of a railway of greater length, possibly prospective only, but a voltage of 10,000 to 15,000. In the case of the Seethalbahn, the adoption of 5,500 to 5,000 volts for the contact line was economical and convenient at the same time for particular reasons. The power required from the trains, even near the extremities of the line, is too little, as to cause inadmissible losses in the contact line. Therefore sectionizing of line, transformer substations and intermediate high-tension distribution were not necessary. If, however, instead of three-phase current, single-phase current of proper periodicity had been obtainable from the plant at Beznau, it is certain that this current would have been conducted to two or three transformer substations on the railway line. These two or three transformer substations would have been a most satisfactory proposition in many respects, cheaper in cost of plant and operation than the one station at Beinwil with converting machinery; but this was excluded by the nature of the current obtainable.

This observation will call attention to the desirability of the generation of alternating current for traction purposes and of the unification of periodicity. Differences in the voltage of different power stations do not signify, as they can always be dealt with by means of transformers at an advantage, all things being considered. But radical differences of periodicity cannot be overcome except in an expensive way.

MARTIGNY-ORSIERES RAILWAY.

The Martigny-Orsières Railway is, as a whole, similar to the Seethalbahn as far as the general conditions are concerned. It is specially interesting for various reasons. The line voltage has been settled at 8,000 volts, a value not very likely to become the standard. The periodicity, however, has been fixed at fifteen, the standard accepted in Switzerland for future electrification. The Martigny-Orsières Railway, branching off at Martigny from the Federal Railways' main line Lausanne-Simplon-Italy, was requested by the authorities to adopt a current of a periodicity compatible with that of electric traction on lines probably coming in operative connection with it in the near future, namely, the Simplon tunnel and the Lötschberg services, both having adopted a periodicity of fifteen. While small differences in periodicity do not prevent transition of locomotive vehicles from lines of the one on to lines of the other periodicity, large discrepancies make it impracticable. Even a large difference in line voltage, though of course very inconvenient, can always be dealt with in a suitable manner.

This railway is interesting from the fact that single-phase current has been adopted after careful investigation into the merits, in the particular case, of continuous current of 2,400 volts, a voltage still in excess of that on the Bellinzona-Mesocco. Then it is extremely interesting on account of the system of motor-speed control as applied to traction.

Contrary to multi-speed three-phase motors, single-phase motors permit of speed adjustment with perfect freedom. The means adopted for this control of speed possess the inherent feature of a step-like action, though by virtue of the number and pitch of the steps these are hardly felt as such within the range of speeds usual in driving.

In the case of the Martigny-Orsières Railway the speed control is an absolutely gradual one, free from the feature of steps. The operation of speed control consists in shifting the brushes on the commutators of the motors, and is therefore, as far as the means external to the motors are concerned, purely mechanical. Instead of controller switch contacts and a certain number of connecting electric conductors, there is, with this novel type of locomotive control, a system of spindles, shafts, bearings, bevel or other gears for transmitting motion by hand power from either of the two drivers' cabins to the several motors on the car. In the case of four inclosed motors being lodged in two bogie trucks below the car body, this mechanical device of speed control will require considerable skill on the part of the designer, and probably considerable attention in service. In the case of locomotives with high-level motors, open and accessible at any time, even when traveling, and rigidly mounted in the frame of the vehicle, the device cannot possibly give rise to mechanical troubles. Whether this system of speed control, as a whole, will prove satisfactory, in general or under special conditions, experience has still to teach.

CONCLUSION.

Railway electrification has made, and is making, noteworthy rather than rapid progress in Switzerland. As regards system, single-phase current of low periodicity (15) and high contact-line voltage, varying from 5,000 to 15,000, according to circumstances, is being sanctioned by experience and by authority.

An important electrification of a new principal line, the Lötschberg, is about to be carried out in the immediate future, and a still more important one, that of the St. Gotthard Railway, is well prepared by the investigations of the Schweizerische Studiencommission für electrischen Bahnbetrieb and by the Federal Railways' purchase of water powers along the line.

Railway electrification and electric traction on a large scale is in a great measure a problem of power-station economics. The heavy variations of load, and those due to rapid seasonal variations in the fresh-water supply, make, under Swiss conditions, water storage desirable and even imperative. All electrification in Switzerland is directly connected with the utilization of water power.

Plans for Los Angeles Subway.

Bion J. Arnold, of Chicago, who was employed a few months ago to make a report of the Los Angeles situation with a view to relieving the present congestion, has finished his report and will soon submit it to the municipality. The scheme as outlined by Mr. Arnold consists of a two-level subway under Broadway and Main Street, with double tracks on each level. One of the levels is to be used for city cars and the other for interurban cars. An elevated on Main Street for interurban cars in lieu of the second level of the subway is offered as an alternative. Estimates show that a double-track, one-deck subway will cost in the neighborhood of $2,000,000 a mile, and the double-deck subway more than twice that amount.

Questions and Answers

All readers of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN are invited to submit questions and answers to this department. Correspondents are requested to send full name and address. This, however, will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered.

Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office not later than ten days after the date of publication of the question. Answers will be published in a subsequent issue.

QUESTIONS.

No. 10.—ELECTROMAGNET DESIGN.—What is the smallest sectional area of core of an electromagnet which will be sufficient to exercise a force of one pound upon an armature two inches away, and what winding should be used? It is to be conected to a 110-volt circuit and used intermittently.—M. E. R., Baltimore, Md.

No. 13.—AUTOMOBILE IGNITION SPARK COIL.—Please give sketch and information on a low-tension spark coil to be used in connection with the make-and-break ignition system of a six-cylinder automobile, to be operated on six volts.—S. L. K., Reading, Pa.

No. 14.—ELECTRIC LIGHTING OF PULLMAN CARS.—The Pintsch gas lighting for railway cars is to some extent being superseded by electric lighting. Please explain the *modus operandi* with reference to the electric generator and accumulators. What is average size in kilowatts of generator and accumulators? What is the efficiency of generator and accumulators? When the generator is working at its highest efficieney, speaking of one Pullman car, what impedance does same offer to the free movement of a train of passenger cars, considering continual side belt strain on axle bearings, magnetic drag, weight of equipment and the like? At what speed of a train, in miles per hour, is the greatest demand of the generator on the free movement of the train, and what is the energy required in horsepower?—H. W. F., Chattanooga, Tenn.

No. 17.—SINGLE-PHASE FAN MOTOR.—We have a twenty-four-inch exhaust fan driven by a one-third-horsepower, 110-volt, single-phase motor. Wind blowing down the thirty-inch duct caused the fan to act as a turbine and run backwards. When I tried to start it up again the motor just hummed, then after a few minutes it started up backwards at a very high speed. I then shut off the power. On again starting it went all right. Why did it go so fast backward the first time?—F. G. D., Lincoln, Neb.

No. 18.—CURRENT FOR ELEVATORS.—If power for lighting and elevator motors in a five-story building is to be bought, is alternating or direct current preferable, and why? With which would the motors cause most fluctuation of the lights? If there were six elevators and from 30 to 125 kilowatts of lighting, would separate generator sets be advisable?—A. B. R., Chicago, Ill.

No. 19.—AMOUNT OF OZONE NECESSARY FOR VENTILATION.—In a hall having a system of forced ventilation with distributed registers, how much ozone should be generated by an ozonizer placed at the intake, in respect to size of hall and number of people; what should be the capacity of the ozonizer in order to properly ozonize the air? On what facts are these figures based? If the ozonizer is not connected with a fan for circulating the air, what proportion should the ozone generated bear to the amount of bad air to be vitalized? How is the ozone thus generated measured as to strength, amount, etc., for any given length of time?—H. M. G., Indianapolis, Ind.

ANSWERS.

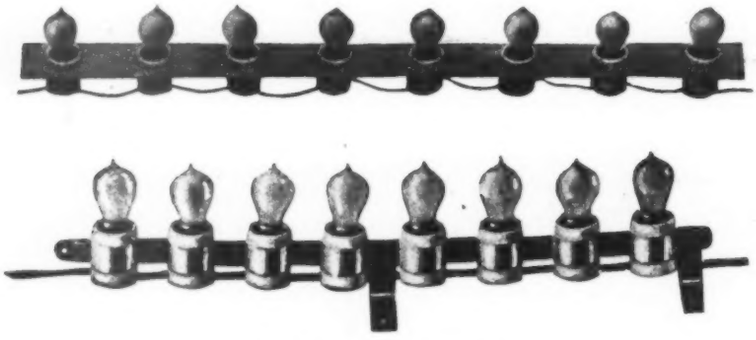
No. 3.—ROTATION NEAR ALTERNATING-CURRENT MAGNETS.—When two metal disks, mounted on pivots so that they overlap and are free to turn, are held over the pole of a magnet excited by alternating current, the disks rotate in opposite directions. Will you explain why this rotation takes place, and why one disk is affected differently from the other?—H. C., Evanston, Ill.

Whenever a rotating magnetic field is produced in the space occupied by a conductor, currents are induced in the latter which produce a torque tending to rotate the conductor in the same direction as the field. This can be shown in any particular instance by tracing out the paths of the currents, but the direction of the torque is most easily found by an application of the law of Lenz. The simplest case appears in the old experiment of Arago, in which a magnet is rotated over a metal disk, or *vice versa*. With a symmetrical magnet excited by alternating current there is no rotation of the field, and a disk placed symmetrically experiences only a repulsion due to the eddy or secondary currents induced in it. If, however, a portion of the pole of the magnet is encircled by a conductor, constituting a closed secondary circuit, the current induced in it exerts a magnetizing effect on a portion of the core, which causes the resulting field not only to be unsymmetrical, but to have a time lag in one part with respect to the other. This is equivalent to a superposition of a stationary field and a rotating field. The latter element will cause a torque upon a metal disk placed in front of the pole, and this scheme is used in some forms of induction meter. If the edge of a disk projects over the pole of the magnet, it constitutes a secondary circuit which will have an effect similar to the conductor encircling a portion of the magnet. If a second disk is then placed over the magnet, it experiences a rotating field and consequently a torque. If the second disk is so placed that it projects over the pole from the opposite side, it will produce a dissymmetry in the opposite sense, and the resultant field acting on the first disk will rotate in the opposite direction.—M. G. L., Oak Park, Ill.

No. 12.—"STRIP" FOR DISPLAY ILLUMINATION.—In the account of the British coronation illuminations that appeared in your issue of July 22, mention was made of the use of "strip" for outline lighting. Please explain what this "strip" material is and just how it is used.—S. J., New Orleans, La.

There are about half a dozen strip systems on the English market. One of them at least was introduced between ten and fifteen years ago, for temporary electrical illuminations, owing to cheapness and ease of installation. Flexible vulcanized indiarubber cable

is mounted with special-type bayonet lamp sockets, and in one system with shade-holders, the sockets being placed at whatever distances apart they may be required—6, 12, 18, 24, 30 or 36 inches. It is made in any lengths and is stocked in coils by some makers in lengths of fifty sockets placed 6, 12 and 24 inches apart in series ready for wiring. The sockets are in either brass or aluminum as required, but the latter were in considerable demand at the coronation owing to the non-corrosive quality of aluminum, making them specially suitable for outdoor use. Rubber rings or sleeves are fitted as a covering for the lamp sockets, so as to render them watertight. "Bro-ite" strip sockets are provided with specially drilled lugs which facilitate installing, saving time and labor. "Striplite," another make, is supplied to different specifications according to the rough usage. It is supplied in lengths of sixty receptacles placed respectively six to thirty-six inches apart, the size of cable being 7/22 or 7/20 according to whether five or eight-candlepower lamps are used for circuits of from 200 to 250 volts. The strip is, however, quite suitable for the same number of 100 to 125-volt lamps, but when used on this lower voltage the mains must be connected to the center of the strip. The flexibility, as will be seen, admits of the strip being twisted to any desired angle. For indoor illumination short lengths of low-voltage different-colored lamp strip is prepared ready wired together with adaptor and flexible cord for connection to any lamp receptacle at a moment's notice.—A. H. B., London, Eng.



TWO FORMS OF "STRIP."

class of outlining or decoration work it is to perform, whether for buildings, arches, lawns, as follows: 3/22 cable, 600 megohm, with watertight porcelain receptacles; 1/18 cable, 600 megohm, with porcelain receptacles supported by zinc strips (see illustration). If for lawns, the zinc strips have stays for driving into the turf. In all these cases "Striplite" is fitted with miniature sockets and two-candlepower, fourteen-volt, round-bulb tipless lamps, clear, frosted or colored, supplied in lengths of eight or sixteen lamps in series ready wired for installing. Prices are quoted per foot including lamps. There are other varieties in form of "Striplite," but those shown are representative examples for different situations and purposes. In "Pixielite" the cable is secured to the receptacle independently of the terminals so that it cannot break away from the receptacle owing to

No. 15.—TWELVE-HUNDRED-VOLT DIRECT-CURRENT RAILWAYS.—I understand that 1,200 volts is now used on a number of direct-current interurban railways. Is it possible to arrange the car wiring so that such a car may enter a city on the ordinary 600-volt trolley lines? If so, how is this done?—N. H., La Salle, Ill.

In railways of this type, the equipment of each motor car consists of four commutating-pole motors, each wound for 600 volts but insulated for 1,200 volts. The motors are in two sets, each of two motors connected in series; this permits of series-parallel control with the sets first in series and then in parallel. As most interurban roads run only short distances into cities and are then required to run at reduced speed, it is customary to make no change in the scheme of motor connections whether operating at 1,200 or 600 volts; this means that on the 600-volt lines the car will not be able to attain more than about half the maximum speed that it does in the open country. However, where it is desired to operate at high speed over a considerable length of 600-volt line, a special change-over switch is provided which breaks the otherwise permanent series connection between the two motors of each set and places them in parallel, so that full-speed normal running is posisble on 600 volts. In all cases an auxiliary dynamotor is provided which is run while the car is on the 1,200-volt line and provides 600-volt supply for the control, lighting and air-compressor circuits.—B. E. R., Niagara Falls, N. Y.

Enormous Coal Valuations.

Under the present scheme of classifying government coal land 56,089,214 acres of withdrawn land had been, on August 1, examined in geological detail and classified by the United States Geological Survey. The lands found to contain workable coal beds aggregated 16,873,370 acres. These lands, in 40-acre tracts, have been appraised by the Survey at a total valuation of $711,992,537, in prices ranging from the minimum figure stated in the coal law—$10 or $20 an acre, according to whether the land is located within fifteen miles of the railroad— to figures of over $400 an acre where the thickness of the coal beds may aggregate 60, 80 or 100 feet, or even more. The government valuations accord in a general way with the market values of private coal lands in the West, although as a matter of fact they are somewhat more liberal to the purchaser.

Under the provisions of the national irrigation law the proceeds from all sales of coal land are credited to the "reclamation fund," so that government irrigation has, as it were, a considerable trust fund for future operations.

Electroplating Aluminum.

If a slight film of brass, containing as much zinc as possible, is first deposited on aluminum, other metals may be plated on in the usual manner. A patent has been taken out in Germany for this process. The inventor recommends a brass anode containing fifty per cent of copper, and a solution consisting of potassium and copper cyanide, 5 ounces; potassium and zinc cyanide, 2 ounces; sodium sulphite, 5 ounces; potassium hydrate, 2 ounces; potassium chloride, 1 ounce; water, 1 gallon. A current density of 2 or 3 amperes per square decimeter is used.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

KINGS COUNTY ELECTRIC.

The report of the Kings County Electric Light & Power Company for the month of July and seven months ended July 31, 1911, compares as follows:

	1911.	1910.
July gross	$ 366,902	$ 341,590
Expenses	185,333	170,765
Jul net	181,569	170,825
Charges, depreciation, etc.	122,773	106,453
July surplus	58,796	64,372
Seven months gross	2,708,964	2,448,651
Expenses	1,350,881	1,167,877
Seven months net	1,358,083	1,280,774
Charges, depreciation, etc.	797,595	717,151
Seven months surplus	560,488	563,623

CANADIAN GENERAL ELECTRIC.

The Canadian General Electric Company has issued its report for the year ended December 31, 1910, which compares as follows:

	1910.	1909.
Operating profit	$911,208	$625,990
Deductions		
Interest	76,820	51,660
Depreciation	188,088	91,093
Total deductions	264,908	142,753
Balance for dividends	646,300	483,237
Preferred dividends	140,000	140,000
Common dividends	354,625	329,000
Surplus	151,675	14,237

The amount available for dividends on the common stock, $506,300 is equal to 9.39 per cent earned on $5,392,737 common stock, compared with 7.30 per cent earned on $4,700,000 common stock last year.

BROOKLYN RAPID TRANSIT.

The Public Service Commission has issued a report for the lines comprising the Brooklyn Rapid Transit system for the quarter ended March 31, 1911, which compares as follows:

	1911.	1910.
Gross	$5,142,746	$4,866,795
Expenses and taxes	3,720,073	3,582,978
Net	1,422,673	1,383,817
Other income	105,382	92,886
Total income	1,528,056	1,476,703
Charges	1,571,148	1,555,515
*Deficit	43,092	78,811

*A deficit is shown due to the fact that intercompany transactions have not been eliminated.

METROPOLITAN STREET RAILWAY.

The Public Service Commission of New York, has issued a report of the receivers of the Metropolitan Street Railway Company for the quarter ended March 31, 1911, which compares as follows:

	1911.	1910.
Gross	$3,194,142	$3,123,950
Expenses and taxes	2,434,426	2,504,370
Net	759,716	619,580
Other income	52,444	57,529
Total income	812,160	677,109
*Charges	651,250	651,393
Surplus	160,910	25,716

*Interest permanently defaulted is not deducted.

THIRD AVENUE RAILROAD.

The Public Service Commission of New York, has made the report of the receivers of the Third Avenue Railroad Company for the quarter ended March 31, 1911:

	1911.	1910.
Total operating revenue	$841,262	$848,339
Net operating revenue	424,211	403,725
*Surplus	259,699	268,227

*After deducting charges and taxes. Interest previously defaulted is not included in charges.

EDISON ELECTRIC COMPANY OF BOSTON.

The report of the Edison Electric Illuminating Company of Boston for the month of July compares as follows:

	1911	1910
July gross	$369,872	$332,594
Expenses	172,044	155,318
July net	197,828	177,276

LONDON UNDERGROUND.

The report of the London Electric Railway Company for the six months ended June 30, 1911, compares as follows:

	1911	1910
Gross	£392,817	£365,624
Expenses and taxes	174,920	167,220
Net	217,897	178,404
Other income	5,713	5,743
Total income	223,610	204,147
Int. on debentures, rents, etc	102,930	107,562
Surplus	120,680	96,583

The report of the Metropolitan District Railway Company for the six months ended June 30, 1911, compares as follows:

Gross	£327,170	£300,046
Expenses and taxes	152,741	143,331
Net	174,429	156,715
Other income	49,028	45,381
Total income	223,457	202,096
Int. on debenture renewals, etc	142,487	140,760
Surplus	80,970	61,336

CITIES SERVICE COMPANY.

The Cities Service Company reports for the ten months ending July 31, 1911: Gross earnings, $751,081; expenses, $23,298; net earnings, $727,783; dividends on preferred stock, $413,955; dividends on common stock, $118,650; surplus, $195,177.

Marconi Wireless Dividends

Marconi's Wireless Telegraph Company, Ltd., has declared at the rate of seven per cent per annum on the capital paid up as on December 31, 1910, on the cumulative participating preferred shares issued on or prior to such date. Also an interim dividend at the rate of seven per cent per annum on capital paid up as on June 30, 1911, on the cumulative participating preference shares issued on or prior to such date, and an interim dividend for the half year ending June 30, 1911, at the rate of ten per cent per annum on the capital paid up on the ordinary shares issued at July 20, 1911. All dividends were payable September 1.

The total length of all the railroads in the world is over 600,000 miles. Over one-half of this is in America and over one-third is in Europe.

AMONG THE CONTRACTORS AND SUPPLY MEN

EVANS & DICKSON, Tacoma, Wash., were awarded the contract for installing a conduit electric lighting system in Wright's Park. The work will cost about $3,000.

J. C. CORBIN & COMPANY, of Seattle, Wash., have been awarded the contact for the installation of the power plant in the new Veterans' Home at Port Orchard, Wash. The contract price was $13,987.

THE ARC ELECTRIC COMPANY, of Kansas City, Mo., which has recently opened an office and shop at 828 Minnesota Ave., will carry a complete line of electrical fixtures and will do general contracting work and repairing.

THE HANCOCK-HOWELL ELECTRICAL ENGINEERING COMPANY, Buffalo, N. Y., was awarded the contract for installing the electrical work on the viaducts at the foot of Genesee Street, and at Washington Street and the New York Central tracks, Buffalo.

THE CARL W. NEWMAN ELECTRICAL COMPANY, Chicago, Ill., which was incorporated with a capital of $6,000, will do general electrical contracting and manufacturing work. The incorporators are Charles C. Cunningham, Charles S. Babcock and Edward J. Dunham.

THE D. J. BRAUN MANUFACTURING COMPANY, Chicago, Ill., has been awarded the contract for installing lighting fixtures in the following buildings: Austin, Minn., postoffice; Clinton, Mo., postoffice; Decorah, Iowa, postoffice; Kokomo, Ind., postoffice; Litchfield, Neb., postoffice and Plattsmouth, Neb., postoffice.

Philadelphia Electric Dividends.

The Philadelphia Electric Company will close its fiscal year on December 31 with a very large surplus. The expectation that some of this surplus is to be distributed, either in the form of an increased dividend rate, or by marking up the paid-in value of the stock, is regarded in well-informed quarters as well founded.

The company has benefited greatly in the present year by the increased sale of municipal lighting, and the contract to deliver electric power to the Philadelphia Rapid Transit Company will also have a perceptible effect.

New Electrical and Mechanical Apparatus and Appliances

Automatic Electric Sand Mixer.

In the foundry the condition of the moulding sand used is of the utmost importance in producing fine castings. There has recently been devised a most interesting form of electrically operated sand-cutting and mixing machine shown in the accompanying illustration, for preparing the sand for this purpose. Where the sand is properly wet and cut by this mixer it is held in perfect condition as the knives make a cut every half inch from top to bottom of the heap, crushing all lumps and leaving the heap uniform throughout. In appearance and texture it is like a heap of riddled sand. The advantages of riddled sand are thus obtained, it is claimed, minus the cost.

Generally speaking, unskilled labor for cutting sand is unsatisfactory, because it is hard to keep laborers on the job and they seldom do the work right. Hand cut sand is always more or less uneven in all foundries, no matter by whom cut. It is claimed that one electric sand mixer, at a labor cost of from $2.00 to $2.50 per day for an operator and about twenty-five cents per day for electric current will cut the sand for about 100 molders, and it will cut it right.

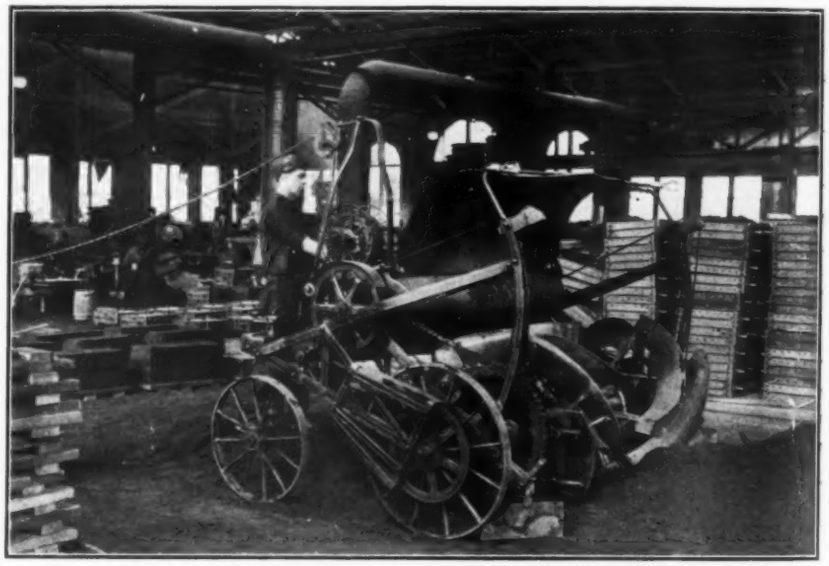
In reference to the construction and operation of this labor saving device it may be mentioned that the cutting cylinder makes seventy-five revolutions per minute; each blade cuts off a small quantity of sand throwing it high in the air behind the machine, breaking all lumps and separating the grains.

The sand is quickly and thoroughly cooled, all of the steam and gas is blown out and the sand left loose and light from top to bottom. Such sand will shovel easier, riddle faster, ram more uniformly, tuck under bars better, and is much less liable to cause blow holes because it is uniform both on the surface of the pattern and throughout the mold.

The electric sand mixer is operated by an electric motor of five-horsepower capacity which is mounted on the machine. The motor, in addition to operating the cutter, propels the machine when it is necessary to move from place to place. Electric current is conducted to the motor by means of a flexible cable carried on an automatic take-up reel, which pays it out and takes it up with but little attention.

The cutting knives are controlled by a multiple-disk clutch which is set so that it will slip and prevent breakage in case the knives strike a casting. The machine is designed for cutting sand for all kinds of light and medium floor molding.

This device has a length of about six feet six inches, the height being about seven feet and the width varying from four feet to six feet six inches between the wheels, according to the work to be done; the extreme width being twelve inches greater than the width between the wheels. It is stated that the machine will turn in a very small space, will straddle castings or other objects and can be successfully handled in very difficult and cramped places.



AUTOMATIC ELECTRIC SAND MIXER.

An Electric Goad.

An electric goad has been given a trial in the stock yards in Pueblo, Colo. This goad, which is used to drive cattle into the cattle cars may be connected to a lamp socket and the slight shock administered is said to be very effective in driving a stubborn animal.

An Electric Speed Recording Device.

The question of the actual speeds and acceleration in the shafts of the Kimberley diamond mines has recently been engaging the attention of the manager, as he was anxious to find out the stresses caused in the hoisting ropes due to the forces of acceleration when the eleven-ton skips were introduced. For this purpose an instrument was designed to determine the velocity of the skip at given short intervals throughout the trip.

The electrical speed-recording device, shown diagrammatically in the accompanying illustration and described by Alpheus F. Williams in the *Journal* of the South African Institute of Electrical Engineers, consists of two main parts, a contact disk on the crank shaft of the engine and a high-speed receiving telegraph instrument. The contact disk is made of brass and is provided with a number of contact studs near its circumference, equally spaced and at the same distance from the center of the disk. An adjustable insulated copper spring is arranged to make contact with the studs as the disk revolves and a continuous contact shoe is fixed to press against the disk by means of a spring.

The two contacts are electrically

connected through a battery circuit to the telegraph instrument, which has the recording tape running at a high uniform speed. The distance between each contact stud on the disk corresponds to a certain known length of rope on the winding drum. Before the engine is started the insulated copper spring contact is adjusted to come close to the first stud which will make contact when the engine starts, and it is then firmly clamped in this position by means of a thumb screw. As the disk revolves with the winding drum, each contact is recorded on the tape of the telegraph instrument, which runs at a constant speed. The time between the first and the last contact having been carefully observed, the total length of the tape from the first to the last signal is now measured and divided into seconds and fractions of a second.

By means of this scale the time between each signal is found. The distance through which the rope has traveled between any two contacts is a known constant, so that the speed of the rope between each two contacts can be conveniently calculated in feet per second. From these data a speed curve is plotted, the ordinates representing speed in feet per second and the base line distance traveled. The "rate of acceleration" curve can be plotted from the speed curve or direct from

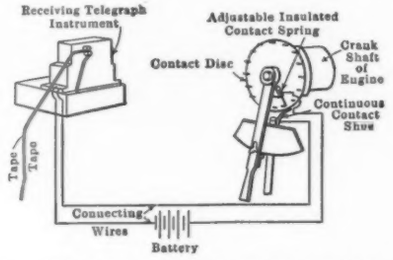


DIAGRAM OF ELECTRIC SPEED-RECORDING DEVICE.

the tape. Knowing the rate of acceleration, several other curves can be arrived at by calculation. Continuous indicator diagrams have also been taken of the engine simultaneously with the speed records.

High-Tension Pittsburgh Transformers.

Operators of high-tension transmission systems are rapidly beginning to realize the possibility of selling power to farms, mills, mines and small communities located within a reasonable distance of the lines, and when properly undertaken this class of service becomes very profitable.

As the volume of business will not as a rule justify the installation and maintenance of substations, many managers have not considered it profitable to cultivate a demand among possible users who, in many instances, would be willing to pay well for the convenience of electricity supply. To meet the demands of this class of service, the Pittsburgh Transformer Company through its sales agent, the Republic

NEW HIGH-TENSION PITTSBURGH TRANSFORMER.

Electric Company of Chicago, Ill., has placed on the market a line of weatherproof high-tension transformers, in all voltages up to 33,000, for use on both 25 and 60-cycle circuits. The conditions surrounding such service have been carefully studied and considered in the design and manufacture of these transformers and the necessity of substation construction and attendance now being removed, a profitable and permanent field for the sale of current from high-tension lines has been opened up.

As is well known, high-tension systems are subjected to excessive strains, due to lightning, surges and static disturbances; and in order to successfully operate under these conditions, transformers must have a very high factor of insulation. In the Pittsburgh weatherproof high-tension transformers the coils are so connected that minimum potential stress is developed between turns or layers of the winding and, in addition, the coils are given a final vacuum and impregnating treatment which not only renders them impervious to moisture but also materially adds to the insulation strength.

As an additional safeguard the incoming and outgoing leads have been brought through extremely heavy corrugated porcelain tubes set at an angle to the base thus maintaining a permanently high factor of insulation between the leads and the ground. As this type of transformer corresponds in a sense to central-station apparatus, care has also been taken to secure close regulation under all conditions of both single and polyphase operation and owing to the interconnected system of coils the effects of low power-factors on regulation are kept at a minimum, thus insuring satisfactory service under a wide range of conditions. The development of Pittsburgh weatherproof high-tension transformers will therefore enable central stations taking on rural customers at a profit.

The Western Electric Company's New Hospital at Hawthorne.

Approximately 13,000 employees of the Western Electric Company are situated at Hawthorne, just outside of Chicago. The company's property at this point occupies more than 150 acres, and here are gradually being concentrated all of its manufacturing activities.

With the realization that it is necessary to look after the welfare of so many workers, the company has recently built and equipped an emergency hospital on

WARD IN WESTERN ELECTRIC EMPLOYEES' HOSPITAL.

the grounds. Its object is not only to relieve distress in time of accident, but also to give aid to any who are taken sick while on duty.

Every detail is complete to furnish surgical aid in cases requiring it, this aid ranging from the major surgical class to fine and delicate operations on the eyes. The hospital does not take care of chronic cases, but merely gives aid in acute cases.

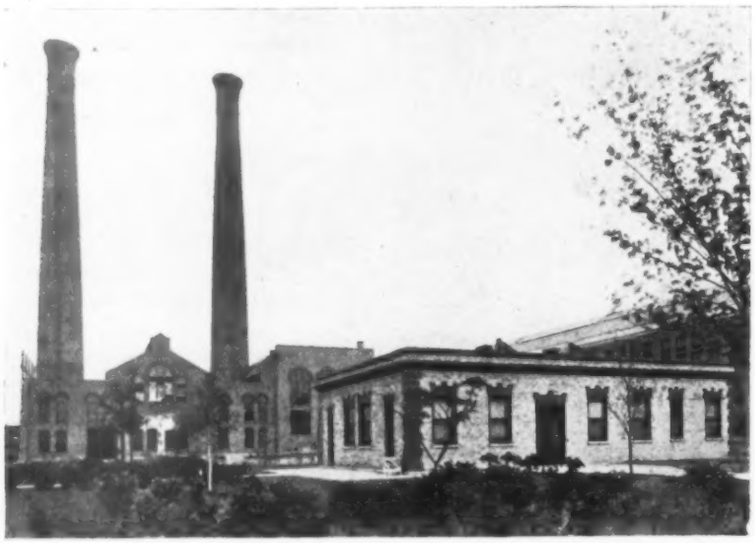
This is not a general hospital, but has been organized for emergency work only. Its construction and the arrangement of its rooms have been to carry out the thought of emergency work and to care

for accidents that arise. Its service is furnished free of expense to employees.

The hospital is equipped throughout with surgical furniture of the latest type and pattern. All rooms wherein surgical work is performed are finished in white enamel, and the walls and woodwork are dust proof. To facilitate cleaning, all the woodwork has been made with round corners. The operating room has no outside openings. There is a double glass overhead skylight and sealed and filtered air is furnished to the room.

Reception rooms are separate for men and women, both opening into a central surgery, where all minor surgical work and redressing is performed. This dressing room contains an X-ray machine, eye magnet, vibrator and equipment for eye examinations. Two wards are provided for men and women, where every appliance is at hand to add to the comfort of the employees. There are also rooms for the use of the surgeon and the nurses.

The hospital staff is headed by a surgeon-in-chief and a supervising nurse. Service is continuous day and night.



WESTERN ELECTRIC EMPLOYEES' HOSPITAL.

The General Motors Truck Company.

The General Motors Truck Company, Pontiac, Mich., has announced the formation of an Electric Division, under J. M. Lansden's management, to market a line of electric wagons and trucks. This announcement comes after months of investigation as every phase in manufacturing and marketing a large production had to be considered. The demand for a production along more comprehensive lines than heretofore possible, has long been appreciated by Mr. Lansden.

Within the past few years storage batteries have been commercially improved and the several distinct types which have been developed offer, under various conditions, their particular and advantageous characteristics. Furthermore, there has been a noticeable extension of the market for electric vehicles, created and developed in numerous instances by central stations

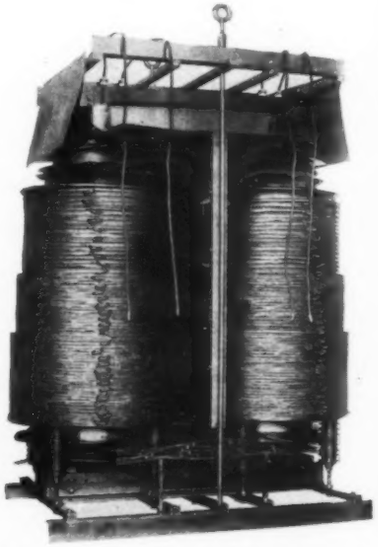
The Electric Division of the General Motors Truck Company will supply all types of electric chassis and wagons. It has no battery, tire nor electric affiliations, permitting the widest range in equipment and assuring that each installation fits the service. It has back of it the resources of a large and well organized manufacturing company. The design is dictated by Mr. Lansden's ten years' experience in the manufacture, operation and maintenance of hundreds of wagons; as well as by the analysis of widely varying requirements to give in general service cheap, but continuous, operation.

The eight classes, varying in load capacity from 1,000 pounds to six tons, will be built in different lengths of frame and wheel base to give in every instance the proper design for the various styles and sizes of bodies necessitated by service. The modern merchant realizes that his particular business requires a definite style and size of wagon or truck, and will appreciate the range offered.

There will be established a completely equipped Service Department with its head at Detroit and branches in various large cities. A corps of commercial engineers will be available at all times in connection with the selection, installation, or operation of motor wagons.

750,000-Volt Testing Transformers.

The increasing demand for high-voltage power-transmission apparatus has made it necessary to produce potentials much in excess of the highest-rated transmission voltages, both for the purpose of insulation testing and the investigation of high-voltage phenomena. Two 500-kilovolt-ampere 750,000-volt testing transformers have recently been built at the Pittsfield Works of the General Electric Company. One of these transformers is for permanent use at the Pittsfield factory, where it will aid particularly in the research and investigation of corona and other phenomena in connection with transformers, oil circuit-breakers, insulators, etc.



750,000-VOLT TRANSFORMER WINDINGS.

These transformers are oil insulated and follow an adaptation of the vertical-core type used generally on high-voltage transformers. The low-tension winding consists of long cylindrical coils placed next to the core on each leg. The high-tension winding consists of a number of double-section circular disk coils with the conductor wound one turn per layer. The terminal coils which are at the top of each stack have smaller outside diameters than the coils lower down so that greater distance is provided between these coils and other parts.

The insulation between high-tension and low-tension windings consists of a number of pressboard cylinders which

divide the space into a number of generous oil ducts greatly assisting in the circulation of oil and increasing the dielectric strength. The insulation between the two stacks of high-tension coils consists of a number of flat pressboard barriers with oil ducts between. The insulation material used is especially treated to give high insulation resistance and low specific capacity.

The supports for the high-tension coils are unique in that they consist of metal upon which the winding directly rests and to which they are electrically connected. These metal supports act as

750,000-VOLT TESTING TRANSFORMER.

shields to the terminal coils protecting them from any discharge which may be induced to ground. While there is a metal shield at both the top and bottom of each stack the windings are supported only at the bottom where the metal shield rests upon heavy porcelain insulators attached to the iron frame work of the transformer.

The tanks are constructed of heavy wrought iron with riveted seams and are provided with substantial cast-iron feet. The cover is of cast iron.

Both high-tension and low-tension leads are brought out through the transformer cover. The low-tension leads follow the usual construction, flexible leads passing through porcelain bushings. The high-tension leads are of the sectional filled type which consist of annular rings of insulating material filled with a semi-viscous compound. To obtain sufficient creeping surface on the outside of the leads, collars are assembled between the annular sections.

The approximate weights and dimensions are as follows:

Floor space	8 ft. by 13 ft.
Height to top of cover	15½ ft
Total height including protective reactances and spark gap	28 ft.
Weight of Core	13150 lbs.
Weight of Copper	1100 lbs.
Weight of Tank and Cover	14000 lbs.
Total weight, less oil	28250 lbs.
Weight of oil	504400 (7000 gal.)

Fielden's Gas Producer.

In the accompanying illustrations is shown a design of gas producer for use with bituminous fuel, which is the invention of Frank Fielden, River View, New Ferry, Chester. In this design the coking of the fuel is effected in a short distillation or coking retort situated at the base of the fire bed within the gas producer proper and passing a convenient distance upwards into the fuel bed, which is fed by fuel forced upwards through the retort by means of a feeding device.

The producer comprises a distillation or coking retort B within the body of the generator proper A. This retort B is of considerably less area than the generator proper, in which it is placed eccentrically as shown. It is supplied with fuel by an upward feed, the fuel being forced upwards from a supply shoot C by the feeding appliance as illustrated, in which is employed a charging cylinder D with a reciprocating trunk piston E in combination with a sliding-valve plate or damper F to feed the fuel upward from the supply shoot C and into the bottom of the coking retort B. The stroke of the piston E forcing up the fuel from the charging cylinder D into the retort B also forces the distilled fuel in the form of coke from the retort B into the producer proper A; and delivers a fresh charge of green fuel into the retort B, the new charge being supported by the valve plate or damper F, which is inserted by automatic mechanism just before the trunk piston E is withdrawn, and is retracted as soon as the piston returns with a fresh charge.

The automatic intermittent feed mechanism illustrated in Fig 2 consists of a stepped rope pulley G driven constantly in one direction and thereby rotating the worm shaft H which drives a worm wheel on a shaft on which is fixed the fuel-feeding cam J and the fuel cut-off cam K. The fuel-feeding cam J raises the piston E by means of a lever L, and the fuel cut-off cam K inserts the sliding-valve plate or damper F by means of the pivoted cut-off lever M, connected by a rod R to the valve plate or damper F. The cam K in its continued rotation comes in contact with an arm S of the lever M and presses it down into the lower position indicated by full lines, thereby retracting the valve plate or damper F. The coking retort B is supplied with air, pre-heated by a series of radial slots N (see Fig. 2), fed by an air jacket O surrounding the gas producer, and the latter is supplied with air and steam, or vapor if required, in any suitable manner. The

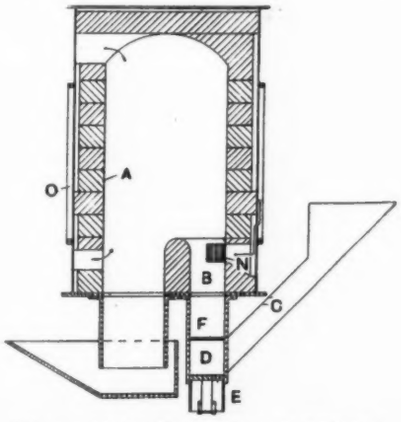


FIG. 1.—DIAGRAM OF GAS PRODUCER.

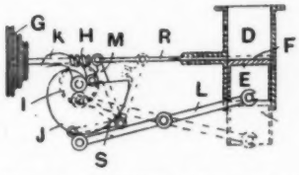


FIG. 2.—FEEDING MECHANISM.

tarry gases distilled from the fuel during its passage through the coking retort B are consumed by combustion with the hot air delivered from the air jacket O through the radial slots N into the retort B, and prior to the delivery of the coked fuel into the generator proper. The heat from the fuel in the generator A keeps the coking retort B hot so that the fuel is heated in the retort previous to reaching the point of air admission slots N. By restricting the area through which the green fuel passes and concentrating the hot air supply to a limited zone, i. e., to the coking retort B, each particle of fuel is supplied with the necessary amount of oxygen to ensure as nearly as possible the complete combustion of its tarry constituents.

Long-Life Flame Arc Lamps.

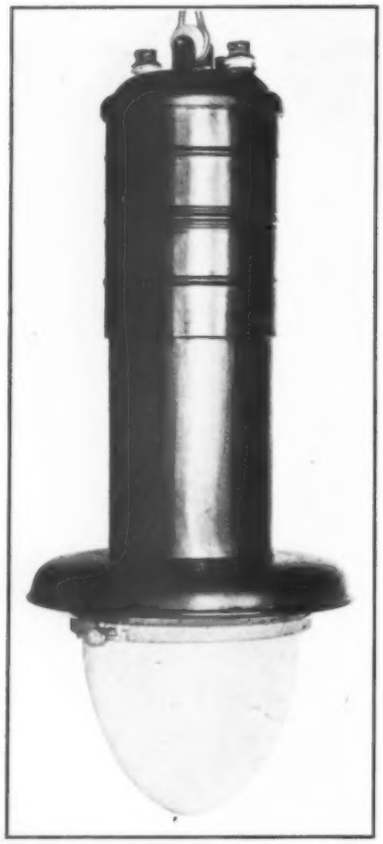
The General Electric Company's new type "K" long-life flame arc lamps are claimed to be the most recent development in this line. They are of the vertical-carbon type and are designed for operation on series alternating-current, multiple alternating-current and multiple direct-current lighting circuits and on direct-current power circuits of all standard commercial voltages.

The mechanism is of the focusing type, maintaining the arc in the same position and giving a steady and even distribution of light. A new form of clutch enables the use of carbons varying considerably in diameter,thus avoiding feeding troubles due to the wear on clutch jaws. The chain wheel is made of alloy with two separate grooves, one for the upper carbon-holder chain and one for the lower carbon-holder chain, each chain being securely fastened to the wheel. As the upper carbon-holder chain unwinds the lower carbon chain winds, always maintaining the arc in the same position. In order to prevent the effects of vibration the cores and coils are suspended by means of compression springs, and except in the case of the series lamps no shunt spools are used, thereby eliminating an accessory that is a prolific source of arc-lamp complaints.

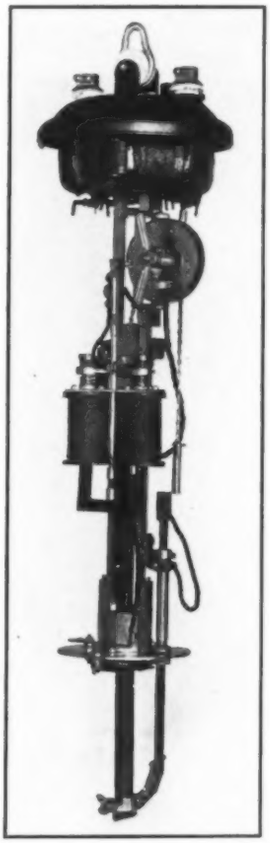
The lamps are provided with two globes. The inner globe is made of either clear glass or opalescent glass. The surface of the open end is ground smooth so as to make an air-tight joint where it rests against the machined surface on the under side of the condensing chamber. It is held tightly against this surface by a phosphor bronze bail spring. The outer globe is held by a retaining spring, the arrangement being specially designed to simplify the operation of trimming. The complete globe holder is hinged to the condensing chamber so that the globe does not have to be removed for trimming, thus obviating trouble that might arise from the globe swinging in the wind and causing it to break by hitting the pole. To lower the outer globe it is simply necessary to loosen the wing-nut provided, allowing the globe to swing downward where it is out of the way. In trimming it is only necessary to renew one carbon, the stub of the upper carbon being placed in the lower holder, thus greatly reducing the cost of maintenance. The casing is made of either copper or steel and is of the telescopic type to permit of ready examination for adjustment or repairs without removing the condensing chamber or globes.

The principle of ventilation applied causes the hot gases to rise from the arc and circulate through the condensing chamber where they are cooled and the fumes condensed and deposited, thus keeping the inner globe clean and the illumination unimpaired. The lamps can be operated without the outer globe if necessary. The arc voltage on the multiple alternating-current lamps is regulated by a reactance, on the multiple direct-current lamp by a resistance, and on the power-circuit lamp by a resistance and a weight for properly balancing the arc voltages when two lamps are burning in series.

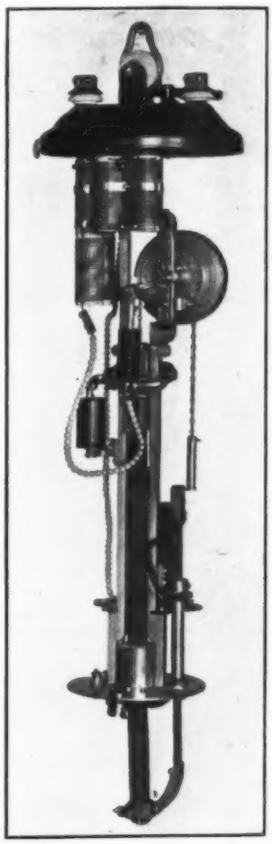
The series alternating-current type has an efficiency of 0.24 watts per mean hemispherical candlepower, and the multiple alternating-current and multiple direct-current types have efficiencies of 0.28 and 0.41 watts respectively.



LONG-LIFE FLAME ARC LAMP.



MECHANISM OF ALTERNATING-CURRENT LAMP.



MECHANISM OF DIRECT-CURRENT LAMP.

Indirect Lighting in Building Corridors.

While the requirements of corridor lighting do not, as a rule, embrace such conditions as are commonly found in shop, office or store-lighting problems, the aesthetic requirements, particularly in the handsome new office buildings are most exacting. In two of the accompanying illustrations are shown installations of indirect lighting successfully applied to building corridors in two of Chicago's most prominent office buildings.

An installation in the main corridor of the new Harvester building is shown in Fig. 2. Around the walls of this corridor are expensive hand paintings of typical western farm scenes. The manager of the building was very desirous of having these displayed to the best advantage and since the installation of the indirect-lighting system has expressed his entire satisfaction with the results obtained. This corridor is ten feet wide, sixty feet long with the ceiling eighteen feet high, and connects with a side corridor seventy-two feet long. Nine units, each containing three sixty-watt and three 100-watt Mazda lamps, are employed, the reflector being of the one-piece silver-plated corrugated type.

In Fig. 3 is shown a similar installation, this being in the Karpen building, on Michigan Boulevard. Here the corridor is 13 feet wide and 124 feet long, with ceiling also eighteen feet high. There are six units installed in this building, each of the same type and containing the same equipment as in the Harvester Building.

One of the most notable installations in corridors is shown in Fig. 1, this installation being in the United States Capitol at Washington. In common with

FIG. 1—LOBBY AT CAPITOL.

most of the passageways and rooms in the old Capitol building, this corridor has an arched ceiling. As will be noted, the entrance is approached through swinging doors, that bring one immediately into this corridor, which is flanked on either side by elevators and large marble arches that support the heavy structure above. Back of these arches are dark recesses, which are practically waste spaces.

At certain times of the day, this entrance way is crowded with members of Congress and visitors passing in and out and using the elevators, and direct lighting, as formerly used in the top center of the dome, furnished very poor illumination, and it was almost impossible to recognize one. Besides this, coming from the daylight into this dimly lighted corridor presented a very gloomy appearance, which was enhanced by the massive architecture and deep recesses mentioned.

As the dome was of a light brown color, with recess panels surrounded by gold moldings, there was a question as to the desirability of attempting the illumination by indirect methods. The fixture as shown, however, containing four indirect lighting units, each containing a 100-watt clear-bulb tungsten lamp, solved this problem in a most satisfactory way.

The appearance of this corridor is now as if there was skylight-daylight illumination from the dome, and the result is such that much favorable comment is expressed.

The installations described herewith were made by the National X-Ray Reflector Company, of Chicago, Ill.

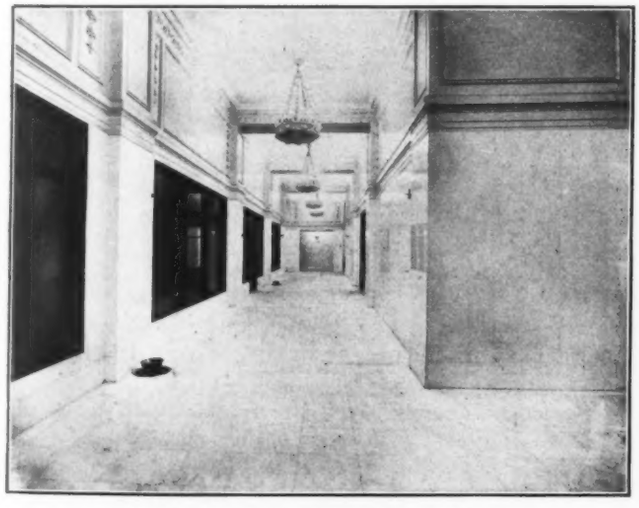


FIG. 2—NEW HARVESTER BUILDING.

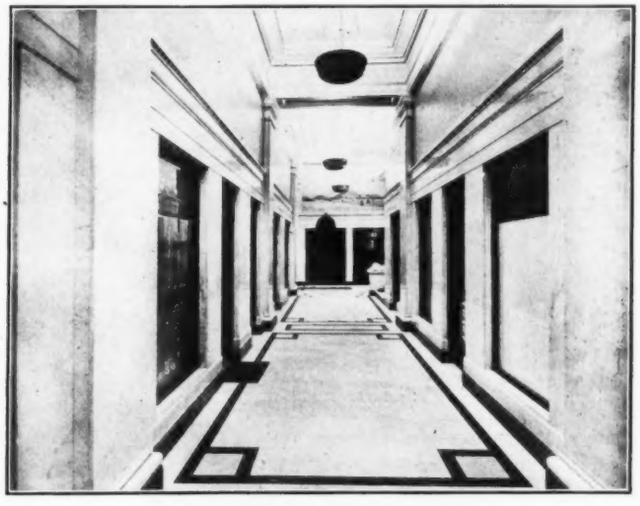


FIG. 3—NEW KARPEN BUILDING.

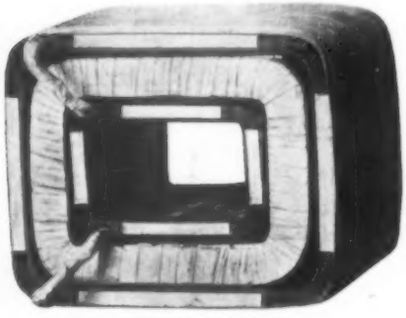
New Western Electric Branch.

That the officials of the Western Electric Company are firm believers in the present prosperity and great future of the south is evinced by the fact that they will soon open a new house there. Arrangements have just been completed whereby the Western Electric Company will soon open a new house at Richmond, Va., where a complete stock of telephone apparatus and supplies will be carried.

Recent Improvements in Distributing Transformers.

About three years ago such marked improvements were made in the design of single-phase distributing transformers that it was thought for a time that further improvements were practically impossible. These improvements were embodied in the type S transformer developed by the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. They consisted principally in a radically new shell design of magnetic circuit whereby low magnetic reluctance is obtained without increasing the mean length of turn of the winding, and which was especially adapted for the use of silicon steel for the magnetic circuit. These improvements resulted in a marked increase in efficiency, better regulation, and a reduction in exciting current, all important characteristics.

So radical were the changes made at



TRANSFORMER COIL.

that time that a large proportion of the electrical fraternity were led to feel that further increases in efficiency and exciting current were impossible. Nevertheless, development of the type S transformers has continued to progress and several marked improvements have been recently announced.

The recent improvements have resulted from improved materials and better mechanical design. The subject of installation has been given special attention, as upon this the life of the transformer largely depends. The insulating materials now used are of better quality both mechanically and electrically, with the result that a further increase in efficiency and reduction of exciting current has been obtained. For example, the seven-and-one-half-kilovolt-ampere type S transformer which formerly had an iron loss of sixty-two watts and copper loss of 125 watts, now has only fifty-seven watts iron loss and 110 watts copper loss. The exciting current has been reduced from 2.2 per cent to 1.7 per cent, and the regulation at 100 per cent power-factor improved from 1.69 per cent to 1.55 per cent. Other sizes show corresponding improved performances.

A very uniform temperature is maintained throughout the entire transformer and in no place does the temperature rise exceed fifty degrees under normal conditions. This insures long life and high all-day efficiency.

In line with the question of insulation, the high-tension coils have been further subdivided, to reduce the voltage between layers of the windings as well as between coils and thus relieve the strain on the insulation.

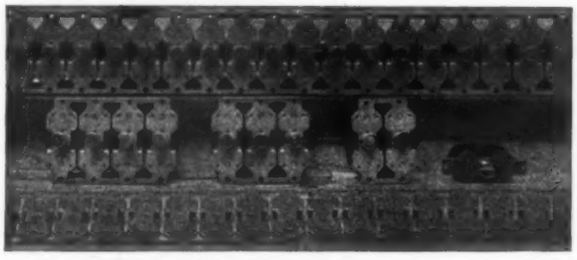
Slight changes have also been made in the terminal bushings to further prevent possibility of grounding to case due to the collection of dust between the bushing and the case and to still further make the siphoning of oil from the case impossible.

A highly flexible weatherproof cable is used for the leads of the type S transformer. These leads are rubber insulated with a grade of rubber that would deteriorate very slowly if exposed to the weather; the rubber insulation is protected by a braided covering.

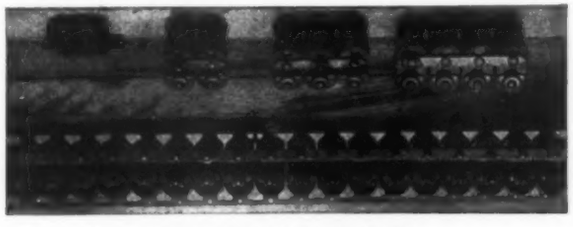
A Yard of Battery Switches.

The new front yoke which is used to assemble gangs of Cutler-Hammer battery switches can be stamped in long strips so that gangs one foot, two feet, or a yard or more can be assembled without any difficulty in alining, as shown in the accompanying illustrations. To separate into single units, two, three or four gangs it is only necessary to use a nipper or hack saw. The new busbar shown in the rear view is also stamped in long lengths. This arrangement eliminates the work of running a wire across the backs of the several switches and provides a neater and more secure connection. The new washers used are cupped so that any size stranded wire from No. 18 to No. 10 B. & S. gauge can be securely held without solder. Standard front yokes and busbars are in four-gang lengths.

These features cut down to a minimum the work and time of installing and make it possible for the jobber or dealer to supply single units or gangs of any size from a minimum stock.



FRONT VIEW OF SWITCHES.



REAR VIEW OF SWITCHES.

Buckeye Summer Convention.

Thirty-one members of The Buckeye Electric Company's sales force held their annual sales conference at Association Island during the week of August 14. Accompaning the party were the wives of six of the men and a number of guests closely associated with the Buckeye organization.

The conference was most successful, both the business meetings and the social features being enthusiastically attended. Addresses were made by F. S. Terry, Ward Harris, Messrs. Henneger and Edwards of the Engineering Department of the National Electric Lamp Association, and by C. Walter Jones, sales manager of the Holophane Company.

In summing up the last year's business and outlining future policies, L. P. Sawyer, general manager of the Company, expressed complete confidence in the business outlook.

Current Electrical News

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission, Second District, has received from Attorney Thomas M. Losie of the town of Elmira a complaint against the maintenance charge exacted by the New York Telephone Company to the patrons in that town. The complainant states that the telephone company charges a flat rate to its subscribers within the city limits of Elmira but patrons residing beyond the city limits are required to pay a maintenance rate over and above the regular rate for each fourth mile, or fraction thereof distant from the city line. Inasmuch as the service rendered the patrons in and outside the city limits is the same, complainant alleges that discrimination exists. He also alleges that the city limits are not reasonable and equitable starting points for an extra maintenance rate, for the reason that the city line has nothing whatsoever to do with telephone service or the cost of same, and for the further reason that the past experience of the company has not proven that it is necessary for it to make such extra charge. It is also contended that the New York Telephone Company is writing four-party and two-party residence service contracts at different rates, and that both services are identical for the reason that the company will not be able for a long period of time to operate four-party lines.

The Commission is asked to enter an order directing the telephone company to discontinue its maintenance charge in so far as the same relates to the district known as the West Water Street district and Elmira Heights in the town of Horsehead.

On August 29 the Commission heard the petition of the Long Island Lighting Company for permission to construct necessary poles and appliances for the furnishing of electricity in the town of Smithtown, Suffolk County, and authority to issue $90,000 in five-per-cent twenty-five-year first-mortgage bonds under an existing mortgage; also the application of the Keeseville Electric Company for permission to construct a transmission line and exercise franchises for the supplying of electricity in the towns of Jay, Essex County, and Ausable, Clinton County.

The Public Service Commission, Second District, has ordered the Delaware & Otsego Light & Power Company to show cause why an order should not be entered requiring it to make reasonable improvements in its electric generating and distributing system in the village of Otsego. The Commission received complaint from the president and members of the Board of Trustees of the village as to the character of electric service furnished there, and an inspector of the Commission found upon examination that the service is irregular in character and generally inadequate and unsatisfactory.

Voluntary reductions in the electric lighting and power rates charged by the Fulton County Gas & Electric Company in the cities of Johnstown and Gloversville, to take effect September 1, so as to apply to bills rendered on and after October 1, 1911, are made in an application received from that company by the Public Service Commission. The rates for lighting are reduced from five, eight and ten cents per kilowatt-hour to four and nine cents per kilowatt-hour, depending upon the amount used by the consumer. The minimum bill of this company for electric lighting remains at fifty cents per month. Electric power rates under the new schedule will be from 1.5 to 9 cents per kilowatt-hour, instead of 2.5 to 10 cents per kilowatt-hour under the existing rate schedules of this company.

The Public Service Commission, Second District, has authorized the Lockport Gas & Electric Company to purchase $32,500 par value of the capital stock of the Lockport Light, Heat & Power Company. This $32,500 of stock constitutes the balance of an original issue of $150,000 heretofore authorized by this Commission and was in the hands of Bertrom, Griscom & Jenks, bankers, of New York City, from whom the applicant desired to purchase the same, that it might hold all of the capital stock of the Lockport Light, Heat & Power Company in accordance with Section 70 of the Public Service Commissions Law.

IMPORTANT DEVELOPMENT.

(Special Correspondence.)

NEW VERMONT POWER PROJECT.—A project for the hydro-electric development of the Deerfield River, promoted by interests connected with a Connecticut River power company, has been launched by the completion of an underwriting agreement for the issuance of $3,000,000 five-per-cent forty-year gold bonds and $750,000 six-per-cent cumulative preferred stock. It is understood that the ultimate expenditure will reach $12,000,000. Initial construction will comprise the damming of the Deerfield River in four places near Shelburne Falls, Vt., as well as the creation of a reservoir at Somerset, Vt.

COMMISSION NEWS FROM VERMONT.

(Special Correspondence.)

In the matter of the petition of the Vermont Telephone & Telegraph Company, for permission to increase its capital stock in the sum of $60,000, the Commission has issued its report and certificate, in which it finds that it will be promotive of the public good that the petitioner be granted permission to increase its capital stock in the sum of $60,000 to be divided into 2,400 shares of the par value of $25.00 each, for the purpose of raising money to pay the present outstanding indebtedness of the petitioner. It is further ordered that the Vermont Telephone & Telegraph Company shall not sell any of the stock for less than par in cash and that it shall, on or before January 1, 1912, and each six months thereafter, until all of the stock is issued, file a sworn return with the Public Service Commission, which shall set forth the amount realized in cash from the sale of the stock and the application of the proceeds.

The Commission has recently sent out various blanks for the annual reports of all public service companies under its supervision, including steam railroads, electric railroads, express companies, gas, electric light and power companies, and telephone and telegraph companies. The blanks used for steam railroads, electric railroads and express companies are prepared by the Interstate Commerce Commission and are practically the same as those in use by that Commission. The blanks for electric light and gas companies were prepared by the Public Service Commission after consultation with a special committee appointed by the Vermont Electrical Association about a year ago. The Commission has recently formulated two new sets of blanks for telephone companies, one kind being for the larger companies and the other for the smaller companies. The blank for the larger companies follows closely the form used for the same purpose by the Massachusetts Highway Commission. Recognizing the fact that most of the smaller companies, farmers' lines, etc., have not facilities and the clerical force sufficient to keep their accounts, and classifications thereof, as fully as are kept by the larger companies, the Commission has adopted a similar and more abbreviated form of report. Altogether there are 174 public-service companies making annual reports to the Commission.

TRUST INVESTIGATION IN TEXAS.

Attorney General J. P. Lightfoot has submitted to the Texas Legislature a report on his investigations of the alleged electrical trust that was said to be operating in Texas. The report, which is lengthy, says in part:

"The Texas companies, which are operated by Stone & Webster, of Boston, Mass., are as follows:

"The Dallas Electric Light & Power Company, Dallas Consolidated Electric Street Railway Company, Rapid Transit Railway Company and the Metropolitan Street Railway Company, which are all owned by the Dallas corporation. In El Paso, the El Paso Electric Railway Company and the Juarez Traction Company are owned by the El Paso Electric Company. The Galveston-Houston Electric Company owns the controlling interest in the Galveston Electric Company, the Houston Electric Company, the Galveston-Houston Electric Railway Company, and also owns stock in the Suburban Realty Company and the Hotel Galvez at Galveston. The Northern Texas Electric Company owns a controlling interest in the Northern Texas Traction Company, the Dallas & Oak Cliff Electric Railway Company and the Fort Worth Southern Traction Company.

"It will thus be seen that the several street railway systems of Dallas, Fort Worth, Galveston, Houston and El Paso are all owned by a holding corporation, which, in turn, is owned, controlled or managed by the Stone & Webster Management Association, which is a corporation organized by the partnership of Stone & Webster.

"All the above corporations are under the management and control of one corporation, through which the electrical supplies and appliances are purchased principally from the General Electric Company.

"To give a more comprehensive idea of the connections existing between the telephone, telegraph, light, power, traction and manufacturing companies of electrical devices as it reaches out into this state I will start from the bottom:

"The four electric railway companies of Dallas are owned by one corporation; the two lines at El Paso by another; the street railway systems of Galveston and Houston by a third corporation, the Northern Texas Traction Company and the Fort Worth Southern Traction Company are owned by a fourth corporation. Each of the four corporations is owned and managed by the Stone & Webster Management Association, another corporation. Some of the stock and bonds of all these Texas companies are owned by the electric

securities companies hereinbefore mentioned, which, in turn, are partly owned or controlled by the General Electric Company.

"The Southwestern Telegraph & Telephone Company, which, in turn, is owned by the American Telephone & Telegraph Company, known as the Bell System.

"The Western Union Telegraph Company is also controlled by the American Telephone & Telegraph Company.

"The Postal Telegraph Company of Texas was until recently owned by the American Telephone & Telegraph Company.

"It will therefore be seen that the lines for telegraphic and telephonic communication in Texas are largely owned and controlled by the Bell System, while the electric street railways find control and domination finally lodged in Stone & Webster and the General Electric Company through subsidiaries.

"We also find that the General Electric Company, the American Telephone & Telegraph Company and the Western Union are strongly tied together through common directors and common stockholders. Each and all of these concerns, that is to say, the Amercian Telephone & Telegraph Company, the Western Union, and the General Electric Company, and all underlying corporations, are dominated by a group of bankers in New York and Boston, chief among whom may be mentioned the firm of J. Pierpont Morgan & Company, Kidder, Peabody & Company, Lee Higginson & Company, and several other banks and trust companies."

The Attorney General discusses water-power concentration and deprecates the evident intention of great corporations to get all this in their own hands and under their domination. Much of the report enters into details affecting the ownership of stock of the various electrical corporations doing business in Texas and tends to show nearly all of them are dominated by the Bell Telephone Company, the General Electric Company and a few others, or, at least, controlled by men who control these companies.

The conclusions of the Attorney General's report are:

"The resolution under the authority of which I have acted made it necessary to examine into the relations of the corporations not only from a legal standpoint but also in the light of the effect of such concentration upon the industrial and economic welfare of the state and nation. Many of the facts which have been set forth are valuable only for the light which they may throw on the great economic questions involved. It would be difficult for street railways or electric light plants in widely separated cities to enter into competition. Moreover, a great many of these concerns have no permit to do business in Texas, and if the facts set forth show any violation of the law by them it would be rather a violation of the laws of other states or of the federal government. The state courts have no jurisdiction to punish offenses which alone affect interstate or international commerce.

"There are also serious legal difficulties involved touching the power of the state to control the actions of corporations which manufacture and deal in patented devices, as it is claimed that the patent rights carry with them certain exclusive privileges and monopolies granted by the Federal Government. These contentions find some support in the federal decisions, but the question has never been definitely and satisfactorily adjudicated by the Supreme Court of the United States.

"While all the facts tend to show a movement toward concentration which will, if persisted in, wield a potent influence over the industrial welfare of the nation, the state is very much handicapped by reason of the limitations of its powers and the law to deal with a subject which is international in its scope and effect.

"The operation in Texas by the Stone & Webster syndicate presents several interesting questions for determination. Their movements have always been predicated upon the most eminent legal advice to be had. So far as I have been able to determine the fact, it appears that the city charters of the various cities in which they operate the local street railway systems confer upon the several city governments a wide control over the matter of franchises, the fares to be charged, the character of the equipment, the service to be rendered the public, the hours of labor for the employees and other pertinent and salient matters which might bring such cases within the reasoning of the decision by the Supreme Court of this state in the case of State against Shippers' Compress Company, 95 Texas, 613, in which the court held that under the facts in that case there was no unreasonable restriction of competition between several of the compress companies which were owned by the same corporation. The Railroad Commission having fixed the amount to be paid by the railroad companies for the service of compressing cotton; and by the regulating the delivery of cotton to the various compresses; competition between the companies operated by defendant was barely possible under the rules fixed by such commission.

"On the question of relations existing between the Western Union and the Bell Telephone system, a different situation appears to exist, and while I do not believe that it is neecssary to pass upon all legal questions involved for the purposes of this report to the legislature, yet I am free to say that the practical combinations between these two great companies trenches upon our anti-trust laws. There can be no competition either in rates or service between two such great concerns where they are practically under the same management and control. This matter shall receive further investigation and consideration at the hands of this department. The department also deems it wise to continue the investigations into the relations, if any, between all these concerns, especially the Postal Telegraph-Cable Company of Texas and the American Telephone & Telegraph Company, the Western Union and the Mackay interests. For a time the Texas Postal was owned and controlled by the Bell system, but, as hereinbefore stated, they claim that they have disposed of that interest. On the question of that branch of the business of the General Electric Company which deals with the manufacture and sale of electrical devices, it will be necessary to conduct a further investigation before it can be definitely stated whether or not any of the pooling arrangements heretofore in existence have been or are now in effect in this state." D.

LIGHTING AND POWER.

(Special Correspondence.)

BRUCE, S. D.—The installation of an electric light plant is planned. C.

GARRISON, TEX.—R. T. Patterson is installing an electric light plant here. D.

TERRY, MONT.—Edward Phillips is about to commence the construction of an electric light plant. C.

PRINCETON, MO.—This city has voted on the issuance of $7,000 in electric light extension bonds.

COWETA, OKLA.—This city has issued bonds for $20,000 for the extension of the electric light plant.

ARLINGTON, S. D.—W. C. Allen and Adam Roym are planning the installation of an electric light plant. C.

KENNEDY, TEX.—J. D. Autry and D. D. McAda have secured an electric light franchise for this place.

CLARKSVILLE, ARK.—This city will soon vote on a $75,000 bond issue for building an electric light plant.

KEOKUK, IOWA.—The Stone & Webster Company has secured a site for the erection of an electric light plant. C.

GOODSPRINGS, NEV.—The Yellow Pine mine plans for the erection of a power plant. J. F. Kent is manager. A.

LIBBY, MONT.—J. A. Coram, of Boston, Mass., is considering the installation of a power plant at Kootenai Falls. C.

SUMAS, WASH.—This city has voted to install a municipal electric lighting system. The estimated cost is $7,000. A.

BUCKHOLTZ, TEX.—W. R. Newton contemplates the establishment of an electric light plant in his sanitarium.

PORTLAND, ORE.—The Pierce-Tomlinson Electric Company has been incorporated by T. F. Pierce and others. A.

MASCOUTAH, ILL.—The proposition to issue $12,000 in bonds for a city lighting plant carried by a large majority.

HUSUM, WASH.—T. M. Cole will install a power plant on Rattlesnake Creek to supply power for pumping plants.

ROLLA, MO.—This city is about to vote on an $8,000 bond issue for the extension and repair of electric light plant.

CLARION, IOWA.—Carr & Mozngo are arranging for the construction of a cement building for the electric light plant. C.

BURNS, ORE.—James D. Fellows has been granted a twenty-five-year franchise for an electric lighting system in this town.

WENATCHEE, WASH.—O. A. Hoag has commenced preliminary work in connection with his proposed power plant at Chelan Falls. A.

SIDNEY, MONT.—The Council granted a franchise to the Sidney Electric & Fuel Company for the operation of an electric light system. C.

ROCHESTER, MINN.—The contract for the installing of a system of street lighting has been let to the W. O. Hartig Company, of Minneapolis. C.

WHITE LAKE, S. D.—A franchise for the operation of an electric light system has been granted to the White Lake Light & Power Company. C.

GILBERT, MINN.—A franchise has beeen granted to the Mesaba Range Electric Company for the construction of its lines through the village. C.

McKINLEY, MINN.—The condition of the village electric lighting plant is such that the replacing of the machinery purchased two years ago is being considered.

HIBBING, MINN.—The Board of Water and Light Commissioners is considering the acquisition of the electric lines connecting the village with Brooklyn. C.

ALAMEDA, CAL.—The City Council has decided to incorporate in the forthcoming bond issue a proposition for $115,000 for electric light plant improvements.

TOPPENISH, WASH.—A fifty year franchise has been granted to the Reservation Electric Company for an electric light and power system for the town of Toppenish.

TEXARKANA, TEX.—The Texarkana Gas & Electric Company recently filed an amendment to its charter, increasing its capital stock from $200,000 to $600,000. D.

KELSEYVILLE, CAL.—James A. Gunn, Jr., has made application for a fifty-year franchise for a transmission line along all public roads in this town and county.

FORT DODGE, IOWA.—E. T. Meredith, A. S. Gilbertson, of Des Moines, Iowa, and others, are organizing a company for the construction of a water power plant. C.

SALT LAKE CITY, UTAH.—An electric light and power plant will be installed in the new department store to be erected by F. Auerbach & Brothers on Third Street. A.

KLAMATH FALLS, ORE.—The Pelican Bay Lumber Company will install a power plant to furnish light and power for the new mill, which will begin work in a short time.

SALT LAKE, UTAH.—The Utah Light & Railway Company has made application for franchise for extension in its lines to Capital Hill and University Heights districts. A.

STANTON, MICH.—The proposition to bond the city for $10,000 to build a municipal electric lighting and water works plant was carried at a special election by a majority of 224 votes.

PHILOMATH, ORE.—The Oregon Power Company is making improvements in this section to cost $15,000. A new transmission line has been constructed from Corvallis to this city.

SACRAMENTO, CAL.—The Blue Lakes Power & Lighting Company, recently incorporated, has commenced the construction of a power line to extend from Lake County to this section. A.

KENNEDY, TEX.—At a special meeting of the City Commissioners an electric light franchise was granted to J. D. Autry and D. D. McAda. The erection of the building will begin soon.

ELY, NEV.—A large electric power plant is soon to be erected on Cleve Creek by the Telluride Power Company of Colorado, to furnish light and power to Ely and the surrounding camps.

LOS ANGELES, CAL.—The City Council has voted $10,500 for use in beginning work on power plants along the aqueduct. The work had already been started but practically without funds.

SHAMOKIN, PA.—The borough electric light plant at Shickshinny has been bought by the Luzerne Gas & Electric Company, which controls the Hazleton gas plant. The price paid was $100,000.

PHILADELPHIA, PA.—A permit has been taken out by the H. E. Grau Company for the erection of a $10,000 power house for the Presbyterian orphanage. The building will be a brick structure.

SPOKANE, WASH.—The Inland Empire Paper Company, at Millwood, plans for the erection of a power and generating plant for complete operation of its paper mill. The estimated cost is $400,000. A.

ATLANTIC, IOWA.—The contract for the installation of an electrolier lighting system on Chestnut Street has been awarded to P. A. Johnson by J. A. McWaid, president of the Booster Club. C.

JARBRIDGE, NEV.—The Jarbridge Power Company, recently organized with a capital of $100,000, plans for the erection of an electric power plant to serve this district. J. M. Kinney is interested. A.

BONHAM, TEX.—The Bonham Gas & Electric Company will erect a new powerhouse and install new machinery at Bonham. The company recently developed an abundant water supply by drilling a deep well. D.

BELLINGHAM, WASH.—A contract has been made between the Western Canadian Power Company and the Bellingham Lighting Company, whereby 6,500 horsepower will be imported before the first of the year.

SPOKANE, WASH.—The International Power & Manufacturing Company has been organized with a capital of $250,000, and plans for the erection of an electric power plant at Millwood. Wilbur S. Yearsley is interested. A.

FRESNO, CAL.—The Pacific Light & Power Corporation of Los Angeles, has filed articles of incorporation here, with capitalization of $40,000,000, in connection with its proposed power plans for development on Big Creek. A.

SOUTH BEND, IND.—The Home Electric Company, of Wakarusa, Ind., has just been incorporated with a capital stock of $15,000, to furnish heat, light and power. The incorporators are J. E. Gail, J. E. Bollenbacher and V. H. Schalliol.

BAKERSFIELD, CAL.—The Bakersfield Gas & Electric Light Company has been incorporated with a fully paid capital stock of $100,000, by H. A. Jastro, H. A. Blodget and L. C. McAfee. Headquarters will be established at Los Angeles. A.

HARRISBURG, PA.—The Harrisburg Light, Heat & Power Company, the pioneer electric company of this city, has been taken over by the Harrisburg Electric Service Company. The stock of the latter company has been increased from $5,000 to $2,000,000.

SAN ANTONIO.—Announcement has been made by the San Antonio Gas & Electric Company, and the San Antonio Traction Company, that $250,000 will be spent in the ensuing year in the improvement of their holdings. This work is now under way.

LA HARPE, ILL.—The La Harpe Telephone, Ice & Power Company has been incorporated with a capital of $10,000 to operate a telephone system and an ice manufacturing plant. The incorporators are Charles H. Todd, John H. Hungate and Abram G. Cox.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company has bid $6.00 per lamp for street-lighting in the suburbs, which is thirty cents lower than former contract. The South Sacramento Power Company bid $6.20. The contract will be awarded September 5. A.

SHENANDOAH, IOWA.—The Shenandoah Artificial Ice, Light, Heat & Power Company has let the contracts for one Murray boiler, 400 horsepower, one 400-horsepower Corliss engine and one Allis-Chalmers dynamo of 250-kilowatt capacity for approximately $13,000. C.

BURWELL, NEB.—Messrs. Reasoner and Beardsley, of Lincoln, have secured subscriptions of $10,000 and plan to dam the Loup River north of Burwell to develop 1,000 horsepower. Plans include the illumination of several towns and the construction of an electric road to Taylor and Almeria.

OLYMPIA, WASH.—The right-of-way for the Olympia Light & Power Company's transmission line from the new reservoir at Lawrence Lake to this city has been secured. This new power project will cost about $300,000 and when completed will supply power and light to the smaller towns near Olympia.

SAN BERNARDINO, CAL.—The contract for the construction of a $300,000 distributing plant, to be built on Poplar street near the Santa Fe tracks, has been let by the Southern Sierra Power Company. This company will spend about $2,000,000 in extending its lines through San Bernardino and Riverside Counties.

YERINGTON, NEV.—The Stone & Webster Construction Company, building the new transmission line of the Truckee River General Electric Company, from Verdi to Wabuska, Nev., sixty-one miles, announces that the line will be in operation by the close of the year. The new power plant and line will, it is stated, cost about $500,000. A.

SACRAMENTO, CAL.—The North Sacramento Light & Water Company has been incorporated with capital stock of $50,000. The directors are: Marshall Diggs, Ray C. Waring and M. N. Williamson, of Sacramento; D. W. Johnston, of Los Galos; G. A. Richardson, of Placerville; Charles E. Hollister and Jas. T. Elliot, of Courtland.

RIVERSIDE, CAL.—Articles of incorporation have been filed by the Pacific Light & Power Company. This is a $40,000,000 corporation having its principal place of business in Los Angeles. Of the capital stock, $7,000 has been subscribed. The directors of the company are: W. G. Kerckhoff, H. E. Huntington, Kaspare Cohn, Charles Forman and Howard E. Huntington.

LOS ANGELES, CAL.—The city has filed on additional power sites on Owens River and Cottonwood Creek, along the route of the municipal aqueduct. This will increase the estimated available horsepower from 120,000 to 150,000. The Power Bureau is preparing plans and specifications, and will soon advertise for bids for electrical machinery. E. F. Scattergood is chief engineer. A.

TOWER, MINN.—Contracts in connection with the construction of an electric light plant have been let as follows: H. L. Bartlett, Virginia, Minn., the dam at Pike River; Fort Wayne Electric Works, Fort Wayne, Ind., electrical machinery; the Dayton Iron Globe Manufacturing Company, Dayton, O., water wheel, and F. McCormick, Duluth, Minn., wiring. It is expected to have the plant running by November 15. C.

LANCASTER, PA.—The Susquehanna Railway, Light & Power Company has purchased the entire holdings of the Manheim & Mount Joy Electric Light Company, which furnished light to the boroughs of Manheim and Mount Joy. The new owners will operate the property and probably make some improvements. The holdings amounted to $50,000 in bonds and $50,000 in stock, which was closely held, the majority being owned by C. S. Stover and S. T. Leland, of Philadelphia.

NANT-Y-GLO, PA.—Improvements that include the expenditure of over $25,000 are under way at the plant of the Nant-y-Glo Light, Heat & Power Company, the controlling interest of which was recently secured by Ebensburg men. Field plans for the work are being prepared by C. C. Dovey. The plans for the new work include the construction of a modern brick power house, large enough for six boilers, each of 900-horsepower, and three alternating-current dynamos, operating at 2,200 volts.

SAN BERNARDINO, CAL.—The Southern Sierra Power Company will construct a $300,000 distributing station on a site recently acquired. The plant, which will be put in operation February 1, according to present plans, will be a feeder to the power line being built across the desert to San Bernardino, from Bishop in Inyo County, by the California-Nevada Power Company. It will distribute electricity over San Bernardino and Riverside Counties. Franchises over roads have been obtained in both counties.

NORTHPORT, N. Y.—Ground has been broken for a large addition to the plant of the Long Island Lighting Company. New machinery will be installed throughout, and, when completed, it will be a 1,500-kilowatt plant, instead of having a capacity of 500 kilowatts as at present. Work is going forward steadily on the construction of the transmission lines connecting the local plant with the Commack, Kings Park and Smithtown sections. In estimates, placed before the Public Service Commission, the company has put the probable expenditure for Northport at $100,000, and for Smithtown and Port Jefferson at $90,000 each.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SHAWNO, WIS.—The Wisconsin & Northern Railway Company has been authorized to extend its lines to Menasha. C.

NORTHFIELD, MINN.—The Dan Patch Air Line, Minneapolis, has commenced the construction of its line to Faribault. C.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company is planning the construction of extensions on four of its lines. C.

TOPPENISH, WASH.—The Reservation Electric Company has made application for a fifty-year franchise for an electric line in this town.

PORTLAND, ORE.—The Mount Hood Railway & Power Company has been granted an electric railway franchise in Eastern Multnomah County. A.

WATERTOWN, S. D.—The City Council has granted a franchise to Ferris Brothers, for the construction of a street railway with a line to Lake Kampeska. C.

INVERGROVE, MINN.—The Interurban Construction Company, of Hastings, Minn., has commenced the construction of a line to Cannon Falls and Rochester. C.

YUBA CITY, CAL.—The Northern Electric Railway plans for the construction of a line from this city to Colusa. A line is also contemplated to Roseville, Cal. A.

GUADALUPE, CAL.—The Pacific Coast Railroad will standardize its electric line between this place and Santa Maria, and will build an extension to Sisquoc, in Cat Canyon. A.

LOS ANGELES, CAL.—The Los Angeles Railway Company will extend its line from West Forty-eighth Street, through the Angeles Mesa tract, a distance of about two miles. A.

SAN FRANCISCO, CAL.—The Board of Supervisors has authorized the Board of Public Works to expend $270,000 in carrying out track construction for the Geary Street municipal railway. A.

LODI, CAL.—The Central California Traction Company is said to be planning for the construction of a line from a point near this city up Dry Creek, Amador County, with extensions to Jackson and Sutter Creek. A.

NEW CASTLE, IND.—The Indianapolis, New Castle & Toledo Traction Company is surveying a route on which to build an extension of the line from New Castle to Richmond by way of Hagerstown and Greenfork. S.

WATERLOO, IOWA.—Coon & Company, contractors, Omaha, Neb., have commenced grading for the interurban line to Oskaloosa, about six miles south of this city. J. E. Sloan, of Circleville, O., is superintendent of construction. C.

DECATUR, IND.—J. H. Koenig, president of the Ft. Wayne & Springfield Traction Company announces that work on the extension of the line to Portland will be begun in a short time. The right of way has all been secured. S.

BAY CITY, MICH.—An interurban electric line franchise has been granted to A. J. Groesbeck of Detroit. The Flint & Saginaw Road will be extended to Bay City and power will be supplied from the plant on the Au Sable River.

SAN BERNARDINO, CAL.—The Pacific Electric Railway Company has secured a right of way between this city and Riverside, seven miles, and will soon advertise for bids for construction. A line will be built from this city to Rialto, and from Urbita to Colton. A.

TELL CITY, IND.—The Vincennes & New Albany Traction Company is the name of a newly organized company to build a traction line from Grandview to Cannelton by way of Troy and Tell City. Meetings are being held by the citizens and much interest manifested in the proposed road. S.

JOHNSON CITY, TENN.—The power plant of the Johnson City Traction Company is being enlarged. A new boiler room is being built and new boilers will be installed. Recently a steam turbine was placed in this plant taking the place of the two engines which have been in use there for some time.

PHOENIX, ARIZ.—It is reported that an extensive system of electric railways is to be constructed through the Salt River valley with Phoenix as the radiating center. As a first step in this direction, Epes Randolph, vice-president of the Arizona Eastern and the Southern Pacific Railroad of Mexico, both Southern Pacific properties, recently acquired control of the street railway system here. Surveys for proposed extensions to various points in the valley are being made. D.

GARY, IND.—It is reported that the organization of the Gary Connecting railway, which is the name of the interurban line now being built between Gary and East Gary, means to serve as a holding company for the merger of the Gary & Interurban, the Valparaiso and Northern, the Gary, Hobart & Southeastern, the Gary and Southern, and the Laporte Interurban Railways, with the proposed Calumet United railways, the Geist interest. This means a big merger of traction interests and it is suspected that the Geist syndicate, which was recently granted a fifty years' franchise, will dominate the corporation. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HARLAN, IOWA.—The Bell Telephone office was damaged by fire, loss $1,000. C.

MITCHELL, S. D.—The Dakota Central Telephone Company will erect a new plant. C.

ABERDEEN, WASH.—Guy M. Harris is constructing a telephone line to Tacoma by the way of Elma. C.

PETALUMA, CAL.—The Petaluma Rural Telephone Company will shortly build a line from Petaluma to Cotati.

CLEBURNE, TEX.—The Santa Fe Railroad will install a lighting and power plant to supply current to the railway shops.

LANESBORO, MINN.—A franchise has been granted to the Farmers' & Merchants' Telephone Company to install a plant. C.

PHOENIX, ARIZ.—The Overland Telephone & Telegraph Company will extend its system to Ash Fork, by way of Prescott.

KALAMA, WASH.—The Cowlitz Bend Telephone Company has been granted a franchise by the Board of County Commissioners.

DEPERE, WIS.—The Fox River Valley Telephone Company has commenced a five-mile extension of its line to the Oneida reservation. C.

CLOQUET, MINN.—The building occupied by the Bell Telephone Company and the Western Union was damaged by fire $5,000 to $6,000. C.

KEOKUK, IOWA.—The Bell Telephone Company has plans by H. E. Radcliffe, architect, for the erection of an addition to its telephone building. C.

COLVILLE, WASH.—The Cedar Creek Independent Telephone Company has petitioned for a franchise for a telephone system through this section.

TRUCKEE, CAL.—The telephone lines of the Pacific Telephone & Telegraph Company between Champtonville and Loyalton will be rebuilt at an early date.

PASCO, WASH.—Estimates have been completed for installing a new system in this town by the Twin City Telephone Company. About $30,000 will be spent.

LAKEVIEW, ORE.—C. H. Lee has been awarded the contract for extending the Nevada, California and Oregon Telephone & Telegraph Company's lines to Lakeview.

LONG BEACH, CAL.—The Pacific Telephone & Telegraph Company will install a conduit system in connection with its new exchange plant. The total work is estimated to cost $140,000. A.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company is having plans prepared for a three-story exchange building in the Sunset district. The estimated cost is $30,000. A.

LONE OAK, TEXAS.—The Citizens' Telephone Company of Lone Oak has purchased the exchange and system of the Lone Oak Rural Telephone Company. The principal lines involved extend from Dixon to Emory, and from Lone Oak to Miller's Grove.

CRYSTAL LAKE, TEX.—The Crystal Lake Telephone Company has been organized for the purpose of putting in a telephone system at this place. W. R. Roykin is president and D. B. Boykin general manager. The company already has a line in operation from Crystal Lake to Alder branch and will make other extensions. D.

CORPUS CHRISTI, TEXAS.—The Nueces River Telephone Company will construct a new line up the Nueces River to Calallen. The poles and materials have been ordered and work will be started at once. The stockholders in the company are Vincent Bluntzer, John Elliitt, C. C. Wright, W. G. Sutherland and Edward Kleberg. D.

BRENHAM, TEX.—The Long Point Telephone Company is extending its lines from Gray Hill toward Independence and is contemplating still further extension. This company now owns sixty-five miles of telephone lines in the county. A movement is on foot in Washington county to organize the numerous rural telephone lines into a single company and run independent of the local exchange. No definite arrangements have yet been made. D.

HOUSTON, TEXAS.—The Automatic Home Telephone Company of Houston has its cable strung in the downtown district, with the exception of one block and is rapidly putting up cable in the residence districts. It is expected to have the system in operation early in September. The pole lines have been practically completed. The exchange building and switchboards are all complete, the outside construction and setting of the instruments being all that remains to be done. About one hundred instruments have been set. D.

PORTLAND, ME.—About $250,000 will be spent during the next twelve months by the New England Telephone & Telegraph Company in improving the service in Portland. About $30,000 additional will be subsequently expended by the company for cable facilities through the various streets of the city. These amounts are exclusive of salaries, office expenses and other items aggregating over $210,000. The $250,000 will include approximately $100,000 for the new building now in process of construction on Forest Avenue, $100,000 for installing and equipping the new switchboard and $50,000 for cable work preliminary to the removal of the exchange from its present location on Exchange street.

ELECTRICAL SECURITIES.

The decline in values noted in the general market has also been felt in electrical securities. The effect on the trade as a whole has been decidedly unsettling as the depreciation in security values has passed beyond that range within which it may have reflected modified views of the immediate and distant future and is now to be attributable to other causes. The aspect of the copper market is not encouraging; its future is said to be largely dependent upon foreign demand.

The Northwestern Elevated stockholders' special meeting has authorized $25,000,000 bond issue by a blanket mortgage, as the directors recommended. The meeting was perfunctory because Chicago Elevated trustees have most of Northwestern's stock. They will hold the bonds against National City's loan, whereby Northwestern retires $19,000,000 first mortgage bonds when due September 1, and pays floating debt.

The Marconi Wireless Telegraph Company has declared a dividend at rate of seven per cent on capital paid up as of December 31, 1910, and June 30, 1911, and on the cumulative participating preference shares issued on or prior to those dates; also an interim dividend for half-year ended June 30, 1911, at rate of ten per cent on capital paid up on ordinary shares issued at July 20, 1911. All dividends become payable September 1.

DIVIDENDS.

Louisville Traction Company; common quarterly dividend of one per cent, and preferred semiannual dividend of two and half per cent, both payable October 1.

Manhattan Railway Company, regular quarterly dividend of one and three-quarters per cent payable October 2.

Metropolitan West Side Elevated Railway; regular quarterly dividend of three-quarters of one per cent on the preferred stock, payable September 1.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Aug. 28.	Aug. 21.
Allis-Chalmers common	6½	6¾
Allis-Chalmers preferred	17	21
Amalgamated Copper	57¼	62
American Tel. & Cable	*78⅜	78⅜
American Tel. & Tel.	132⅜	134
Brooklyn Rapid Transit	74¾	76¼
General Electric	151	154¾
Interborough-Metropolitan common	14	15¼
Interborough-Metropolitan preferred	42⅛	43½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	83	83½
Mackay Companies (Postal Telegraph and Cables) preferred	72	74
Manhattan Elevated	134	135
Metropolitan Street Railway	*18	18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	37¾	40
U. S. Steel common	69⅞	73⅜
U. S. Steel preferred	114	115⅝
Western Union	74	75½
Westinghouse common	64	66½
Westinghouse preferred	112	118¼

*Last price quoted.

BOSTON.

	Aug. 28.	Aug. 21.
American Tel. & Tel.	132⅜	134
Edison Elec. Illuminating	286	287⅜
General Electric	151	154
Massachusetts Electric common	17¼	20
Massachusetts Electric preferred	88	90¼
New England Telephone	145	149
Western Tel. & Tel. common	16½	19
Western Tel. & Tel. preferred	96½	96½

PHILADELPHIA.

	Aug. 28.	Aug. 21.
American Railways	44¾	44½
Electric Company of America	11¾	11⅞
Electric Storage Battery common	51	52½
Electric Storage Battery preferred	51	55
Philadelphia Electric	16⅞	17¼
Philadelphia Rapid Transit	22¼	23
Philadelphia Traction	84⅜	86½
Union Traction	50¼	51¼

CHICAGO.

	Aug. 28.	Aug. 21.
Chicago Elevated Railways, common	24	25
Chicago Elevated Railways preferred	85	88
Chicago Railways, Series 1	90	95
Chicago Railways, Series 2	27	29¾
Chicago Subway	2½	2⅞
Chicago Telephone	120	123
Commonwealth Edison	132	134
National Carbon common	100	100
National Carbon preferred	115	117

PROPOSALS.

MOTOR-DRIVEN WINCH.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is inviting proposals until September 12, 1911, for one motor-driven winch, to be delivered at the Mare Island Navy Yard within 120 days after the date of the contract.

ELECTRICAL EQUIPMENT.—The Washington State Board of Control will receive bids until September 15 for electrical equipment for the Northern Hospital for the Insane, Sedro-Woolley, Wash. Plans and specifications may be secured at the office of Saunders & Lawton, architects, Seattle, Wash. A.

NAVAL SUPPLIES.—The Bureau of Supplies and Accounts is calling for the following proposals to be opened on the dates named below:

Date.	Material.	Amount.	Place.
Sept. 5	Rubber-insulated lead-sheathed cable	4,600 feet	Norfolk Yard.
Sept. 5	Sheet mica 6 by 6 inches	1,000 sheets	Eastern Yard.
Sept. 5	Round ebonite rod	12,553 feet	Eastern Yard.
Sept. 5	Oil-proof two-conductor cable	2,500 feet	Washington Yard.
Sept. 19	Motor-driven winch	1	Mare Island Yard.

PERSONAL MENTION.

HENRY L. DOHERTY, president of the electrical engineering and financing house of H. L. Doherty & Company, New York, returned last week from a three-months' sojourn in European capitals greatly refreshed by his extended rest.

J. FRANK DOSTAL, superintendent of the electrical department of the Denver Gas & Electric Light Company, has been chosen as general manager of the Colorado Springs (Colo.) Electric Company. Mr. Dostal has been connected with the Denver Company for ten years as engineer, chief engineer, and for several years as superintendent of the electrical department.

H. E. RIGGS, of the Riggs & Sherman Company, Toledo, O., has returned to that city after a trip to Georgia, where he appeared before the State Railway Commission in behalf of the Savannah Traction Company, as an expert witness in the matter of valuation for taxation purposes. He is now in Marquette, Mich., filling a similar engagement in connection with the Duluth, South Shore & Atlantic Railway.

ARTHUR S. HUEY, first vice-president of H. M. Byllesby & Company, Chicago, has accepted an invitation to speak before the coming convention of the American League of Municipalities to be held at Atlanta, Ga., October 4, 5 and 6. Mr. Huey will talk on the general subject of public-utility regulation and will thus be given an opportunity to present to city authorities the aspect of this vital question from the viewpoint of the public-utility operator. Over 700 municipalities are represented in the League.

H. B. BROOKS, of the Bureau of Standards, will act as a delegate to the International Electrotechnical Congress at Turin, Italy, on behalf of the Bureau of Standards and the American Institute of Electrical Engineers. As previously announced, Mr. Brooks has been temporarily transferred to the Bureau of Manufactures of the Department of Commerce and Labor, to investigate trade conditions abroad with respect to electrical industries, especially measuring instruments and meters, and materials entering into their construction. He sailed August 22 for Germany, and will spend a number of months in visiting the electrical instrument makers and laboratories of England, Germany, France and other countries. Suggestions in regard to his work will be welcome, and may be addressed to him "Care Bureau of Manufactures, Washington D. C."

A. D. CURTIS, of the National X-Ray Reflector Company, Chicago, has recently returned from a four-months sojourn in Japan, highly enthusiastic over business and social conditions in the Orient. Mr. Curtis sailed last March and his trip included visits to the Philippine Islands, Japan and China with extended interior trips. In Japan Mr. Curtiss reports that electrical conditions, particularly as regards electric lighting and railways, are improving very rapidly and many of the power plants visited were on a par with those in this country. The telephone systems in some of the larger Japanese cities which are owned by the government, are, however, not up to the standards' set by the other utilities. Mr. Curtis made quite a study of social conditions both in China and Japan and also made several trips to the old Chinese battle fields which are very seldom visited by tourists. He returns to the office refreshed and ready for a strenuous business campaign.

OBITUARY.

S. W. MANNING, superintendent of the fire-alarm telegraph of St. Paul, Minn., and chairman of the Executive Committee of the International Association of Municipal Electricians, was killed by electric shock while investigating trouble on fire-alarm wires in St. Paul. As a consequence of Mr. Manning's death the place of meeting of the International Association of Municipal Electricians has been changed from St. Paul to Atlantic City, N. J.

INDUSTRIAL ITEMS.

THE ROESSLER & HASSLACHER CHEMICAL COMPANY, New York, N. Y., has issued its August price list of chemicals.

THE DUPLEX METALS COMPANY, Chester, Pa., advertises copper, iron and copper-clad ground rods in a recent folder. An illustration of each style is shown.

THE STAUNTON DIELECTRITE RUBBER COMPANY, Muskegon, Mich., announces that it has erected at Muskegon, Mich., a plant devoted to the manufacture of Dielectrite, a molded insulation for high and low tension. The material is very hard, but can easily be either machined or molded to any desired shape.

THE STATISTICAL SERVICE COMPANY, Chicago, Ill., has mailed an attractive booklet under the title "A Modern Midas." The subject dealt with regards the compilation of statistics with the aid of automatic sorting and tabulating machines. The machines are electrically operated.

THE NATIONAL CONDUIT & CABLE COMPANY, New York, N. Y., covers the field of the copper industry very thoroughly in its weekly publication *Copper Gossip*. The company manufactures bare copper wire, weather-proof wires and cable, and lead-covered wires and cables for telephone, telegraph, electric-light and power work.

THE C. W. HUNT COMPANY, New York, N. Y., lists electric locomotives for both storage-battery and trolley operation in a recent catalog. This company was among the pioneers in the development of the electric locomotive and carried on early experiments in train haulage by electricity. A number of types of electric locomotives are illustrated.

THE AMERICAN-LA FRANCE FIRE ENGINE COMPANY, of Illinois, successors to the Babcock Fire Extinguisher Company, is issuing folders descriptive of Imperial non-explosive cans. These cans are made to contain gasoline, benzine and other explosive liquids. The company's offices are located at 373-375 Wabash Avenue, Chicago.

THE AMERICAN SHIP WINDLASS COMPANY has recently received repeat orders for Taylor stokers from the Pittsfield works of the General Electric Company, making the fourth order for stokers; from the New York, New Haven & Hartford Railroad Company, for their new plant at Waterbury, Conn., making two orders for this plant, and from Northern Ohio Traction & Lighting Company, Akron, O., and the Solvay Process Company, Syracuse, N. Y.

THE HYGRADE INCANDESCENT LAMP COMPANY, Danvers, Mass., announces that it has installed a system of shop practice and inspection which renders it practically impossible for any but perfect lamps to leave the factory. The company offers to give credit for any tungsten lamps broken in transit which is a practical guarantee of the excellence of the product. Means of improving the types of lamps now in use, are being devised so that Hygrade lamps will excel in strength, length of life and efficiency.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind., describes and illustrates the Duncan direct-current watt-hour meter in a bulletin which has just been distributed. Each of the special points of the meter is taken up separately, completely explaining both construction and operation. As a preface some interesting notes on the selection of a meter have been given, and at the back some paragraphs entitled "Good Things to Remember," impress the importance of properly caring for the instrument.

THE BRILLIANT ELECTRIC COMPANY, 401 Electric Building, Cleveland, O., had opened as of August 1, 1911, at 151 New Montgomery St., San Francisco, Cal., a branch office which will be in charge of E. D. Hand, the company's Pacific Coast representative. Orders for incandescent lamps received at the new office will be covered by prompt shipments from the neighboring warehouse at Oakland. Another "Brilliant" office has been opened in Los Angeles, California, and will be under the management of Clarence W. Cole, who until recently represented the company in Cleveland and vicinity.

THE ROBB ENGINEERING COMPANY, LTD., South Framingham, Mass., recently reecived a number of important orders, among which are the following: 42-inch by 14-foot horizontal return-tubular boiler with uptake for George H. McClean Company, Springfield, Mass.; 54-inch by 12-foot-2-inch horizontal return-tubular boiler for A. H. Kidder, Beverly, Mass.; 48-inch by 14-foot horizontal return-tubular boiler for Tower Brothers, Hudson, Mass.; 54-inch vertical boiler for the American Bridge Company; two 60-inch by 17-foot-4-inch horizontal return-tubular boilers for Wyckoff & Lloyd, Springfield, Mass.

THE ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, Pa., nas issued Volume I of its catalog No. 4. It pertains exclusively to material used in the construction and maintenance of electric railways and general outdoor electrical work with kindred tools and supplies. Volume II covers electric car equipment and Volume III is devoted to mine and industrial electrical supplies. The three volumes supersede and cancel all previous lists and catalogs issued by the Mayer & Englund Company, Philadelphia, Porter & Berg, Chicago, and Garton-Daniels Company, Keokuk, Iowa, of which firms this company is successor.

W. N. MATTHEWS & BROTHER, St. Louis, Mo., refer in a recent letter to a number of prominent St. Louis engineers who have used the Matthews fuse switch and are ready to testify to the excellent results obtained. A booklet just issued by the company describes the operation of the fuse switch, and also includes a series of pictures showing exactly how the blown fuse is taken out and a new piece of fuse wire put in. The change can be easily and quickly made, and it is accomplished with no danger to the lineman. Leaflets inclosed with the booklet describe the Matthews Giant boltless clamp, and the Matthews Baby boltless clamp.

THE RICHMOND ELECTRIC COMPANY, Richmond, Va., has included in a recent bulletin a set of engravings completely illustrating its line of polyphase motors. In addition a number of applications are pictured showing the wide field of the applications of the company's product. The Richmond Electric Company has been closely identified with the manufacture of alternating-current motors since 1905. The attention of its engineers has been devoted exclusively to the design of polyphase motors, so that an exceptional product has been developed. Recognition of the excellence of the Richmond polyphase motors is shown by the number of machinery manufacturers who purchase these motors for resale after direct connecting or gearing them to their machines.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburgh, Pa., has received, among others, an order from the Minneapolis General Electric Company for three 1,000-kilovolt-ampere, 13,200-volt transformers. The Great Shoshone & Twin Falls Water Power Company, of Twin Falls, Idaho, has placed an order for five seventy-five-kilovolt-ampere, 24,000-volt self-cooled transformers. The Pacific Gas & Electric Company, of San Francisco, Cal., has ordered ten 1,000-kilovolt-ampere, self-cooled tubular-type 11,000-volt transformers. The Cincinnati Traction Company, Cincinnati, O., has placed an order with the Westinghouse Electric & Manufacturing Company for an equipment for generating station and three substations consisting of one 6,000-kilovolt-ampere, twenty-five-cycle, 13,200-6,600-volt, three-phase turbo-generator, with direct-connected exciter; five 1,500-kilowatt, twenty-five-cycle, six-phase, 600-volt rotary converter, sixteen 500-kilovolt-ampere, twenty-five-cycle, 13,200-6,600-volt, oil-insulated, self-cooled transformers; also four switchboards.

DATES AHEAD.

Old Time Telegraphers' and Historical Association and the United States Military Telegraph Corps. Thirteenth annual reunion, Atlantic City, N. J., September 5-7.

Pennsylvania Electrical Association. Annual convention, Conneaut Lake, Pa., September 6-8.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 12-15.

Vermont Electrical Association. Annual meeting, Lake Dunmore, Vt., September 13-14.

International Municipal Congress and Exposition. Chicago, Ill., September 18-30.

Northwest Electric Light and Power Association. Annual convention, Spokane, Wash., September 21-22.

American Electrochemical Society. Twentieth general meeting, Toronto, Canada, September 21-23.

Illuminating Engineering Society. Annual convention, Chicago, Ill., September 25-27.

American Mining Congress. Thirteenth annual meeting, Chicago, Ill., September 25-30.

Georgia Section of the National Electric Light Association. Annual convention, Columbus, Ga., September 26 and 27.

National Association of Cotton Manufacturers. Semi-annual meeting, Equinox House, Manchester, Vt., September 27-30.

American Electric Railway Association and affiliated associations. Annual convention, Atlantic City, N. J., October 9-13.

Association of Railway Electrical Engineers. Annual convention, La Salle Hotel, Chicago, November 6-10.

National Electric Light Association. Next annual convention, Seattle, Wash., June 10-14, 1912.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 22, 1911.

1,000,989. RECORDING DEVICE. George F. Card, Fort Wayne, Ind. Filed March 4, 1908. A machine whose operation is to be recorded has an electric recording attachment associated with a clock.

1,001,012. PNEUMATICALLY OPERATED ROCK-DRILLING ENGINE. George A. Fowler, Denver, Colo. Filed May 19, 1910. An electric motor drives the air compressor for the outfit.

1,001,015. GAS-ENGINE CONTROLLER. William L. Gile, Greenville, Mich. Filed April 15, 1907. Renewed Dec. 17, 1909. The controlling lever has mounted on it a switch for the ignition circuit.

1,001,021. AUTOMATIC MAIL-CARRIER. John Gronek, Philadelphia, Pa. Filed June 7, 1911. A telpherage system in which the cars are equipped with an electric motor and wheels on top and bottom of the car running on rails over and below the car. These rails also serve as the working conductors and the wheels also act as trolleys.

1,001,023. CIRCUIT-CONTROLLING SYSTEM. Jay H. Hall, Cleveland, Ohio, assignor to Electric Controller Manufacturing Co., Cleveland, O. Filed Nov. 23, 1910. A motor controller includes a resistance, a magnetically operated main switch, a master switch for connecting the winding of the main switch in series

with the resistance and a shunt around the winding, the shunt including contacts on the master switch and controlling the current in the winding.

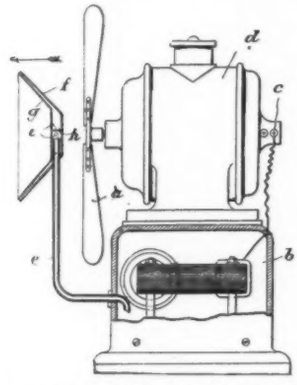
1,101,032. ELECTRIC SWITCH. Harry R. Hirst, New Bedford, Mass., assignor of one-half to Charles S. Knowles, New Bedford, Mass., and one-half to John H. Parker, Saugus, Mass. Filed Nov. 5, 1909. A supporting member for a push-button switch comprises a perforated cross bar and arms in the form of a yoke integral with, and depending from this cross bar.

1,001,035. TERMINAL BLOCK FOR HIGH-TENSION APPARATUS. Theodore Hubert, New York, N. Y., assignor to Charles F. Splitdorf, New York, N. Y. Filed Oct. 17, 1907. An insulating and housing block has a recess to receive the terminal connection.

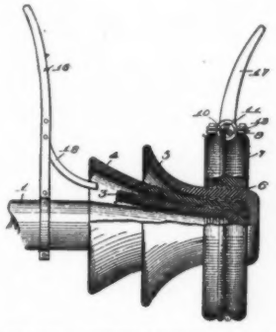
1,001,038. APPARATUS FOR PURIFYING AIR. Friedrich Georg Janisn, Pheydt, near Dusseldorf, Germany, assignor to Otto Von Mulmann, Brussels, Belgium. Filed May 15, 1911. Consists of an electric ozonizer on which is mounted an electric fan. A discharge tube from the ozonizer leads to a funnel-shaped screen in front of the fan.

1,001,046. SIGNALING-HORN. Arthur Atwater Kent, Philadelphia, Pa. Filed Feb. 28, 1910. Is provided with a pair of electromagnets, whose armatures set up the vibrations in the diaphragm.

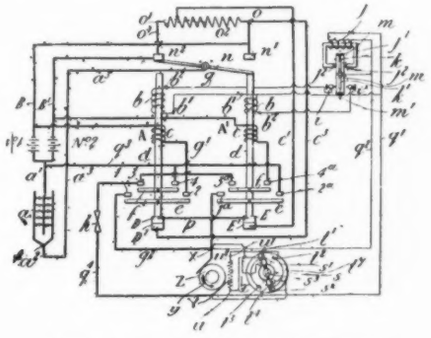
1,001,047. ELECTRICAL POWER TRANSMISSION. Hans Kleinschmidt, Berlin-Wilmersdorf, Germany. Filed Sept. 11, 1909. Includes a number of unipolar machines, means for electrically



1,001,038.—ELECTRIC OZONIZER.



1,001,137.—INSULATOR PROTECTOR.



1,001,358.—TRAIN-LIGHTING SYSTEM.

connecting them and means for distributing the working currents of the machines uniformly along their magnetic fluxes.

1,001,068. APPARATUS FOR GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY AND THE CONTROL THEREOF. Walter P. Neubert, Swissvale Borough, Pa., assignor to Union Switch & Signal Co., Swissvale, Pa. Filed Jan. 17, 1911. An interlocking switching tower has its levers and other mechanism electrically controlled.

1,001,070. LOCK-OUT TELEPHONE SYSTEM. Nils Emel Norstrom, Chicago, Ill. Filed June 6, 1910. A party line has each subscriber's instrument provided with a step-up device which is arranged to disable the instrument until it performs a complete cycle of operations and has its moving parts return to normal position.

1,001,091. DEVICE FOR RECORDING VARIATIONS IN SYNCHRONOUS RUNNING OF KINEMATOGRAPHS AND GRAMOPHONES. Francis Alexander Thomassin, Streatham, England. Filed April 12, 1909. An indicating needle is driven one way or the other by a differential mechanism, one side of which is mechanically geared to the picture machine and the other electrically driven to correspond to the speed of the talking machine.

1,001,105. MANUFACTURE OF ELECTRIC FILAMENTS. Carl Auer von Welsbach, Vienna, Austria-Hungary. Filed Aug. 24, 1899. Renewed Aug. 21, 1909. The process of eliminating occluded gases from a filament containing osmium and a metallic oxide consists in raising the temperature of the filament to a degree sufficient to expel a portion of the gases therefrom, but lower than the reduction temperature of the oxide and thereafter raising the temperature of the filament still higher and effecting the desired reduction thereby.

1,001,135. FILAMENT SUPPORT. Howard Gilmore, Brookline, Mass. Filed Jan. 30, 1911. An incandescent electric lamp comprises a glass stem, a filament support having a coefficient of expansion greater than that of the stem and presenting a gripping head surrounding a portion of the stem, thus firmly securing the filament support in position at all times upon the stem but expanding away from the glass when heated so as not to fracture the glass while remaining engaged therewith.

1,001,137. INSULATOR PROTECTOR. Walter T. Godard, Victor, N. Y., assignor to Locke Insulator Manufacturing Co., Victor, N. Y. Original application filed June 12, 1908. Divided and this application filed Oct. 25, 1909. Combined with a horizontal support, is an insulator having a horizontally arranged flared portion, an arcing member secured on the insulator, and an arcing member secured to the support and having a portion projecting into the flared portion of the insulator.

1,001,152. ATTACHMENT FOR ELECTRIC MOTORS. William A. Lawrence, Charlotte, N. C. Filed Nov. 19, 1910. A disk secured around the shaft contains a number of slidable contact elements adapted to move radially in channels of the disk and arranged to close an electric signal circuit.

1,001,171. ATTACHMENT FOR TALKING MACHINES. Frederick W. Schmidt, Philadelphia, Pa. Filed March 8, 1911. An electric brake for a talking machine includes an adjustable finder bar carrying a contact device adapted to predetermine the actuation of the brake at the close of the reproduction automatically upon positioning of the finder bar, a sound-box arm and an electric circuit connecting the contact device and sound-box arm.

1,000,174. ELECTRIC CRANKING DEVICE FOR AUTOMOBILES. Edward A. Scott, Kansas City, Mo. Filed Aug. 8, 1910. A motor is arranged to start the engine shaft through a pair of clutches and a secondary shaft.

1,001,192. GAS-LIGHTING BURNER. Ernest A. Frary and Edward N. Frary, South Deerfield, Mass. Filed Aug. 18, 1910. Includes an electromagnet, its armature and ignition points.

1,001,196. APPARATUS FOR TESTING TUBES TO DISCOVER OBSTRUCTIONS THEREIN. Victor C. Gilpin, Brooklyn, N. Y., assignor to Eastern Flexible Conduit Co., Brooklyn, N. Y. Filed Mar. 7, 1911. Comprises a hollow electro magnet arranged to surround the tube, means for drawing the tube through the magnet, and an armature for the magnet arranged loosely within the tube.

1,001,206. ILLUMINATED SPIRIT LEVEL. James Irwin McCullough, Davenport, Iowa. Filed Jan. 5, 1911. Is provided with a dry battery and two incandescent lamps for lighting up each of the bubble glasses.

1,001,227. AERIAL FOR WIRELESS TELEGRAPHY AND TELEPHONY. William E. D. Stokes, Jr., New York, N. Y., and George W. Davis, Galilee, N. J., assignors to William E. D. Stokes, New York, N. Y. Filed Oct. 9, 1908. Combined into an aerial are two vertical points of support, a wire between the same, a series of vertically arranged wires standing in a plane, and a switching device by which any of the aerial wires alone can be connected to the receiving circuit.

1,001,228. RECEIVING CIRCUIT FOR WIRELESS TELEGRAPHY AND TELEPHONY. William E. D. Stokes, Jr., New York, N. Y., and George W. Davis, Galilee, N. J., assignors to William E. D. Stokes, New York, N. Y. Filed Oct. 9, 1908. Comprises an aerial formed of insulated wire, and a large copper plate connected to the aerial, the plate being embedded in insulating material, and supported parallel with the ground by insulating standards to form a condensor with ground as the other plate.

1,001,236. ELECTROMAGNETIC SOUND-WAVE THERAPEUTIC APPARATUS. Emile Bachelet, New York, N. Y. Filed Aug. 7, 1908. Includes a pair of opposed generators, each comprising a casing having an opening in one end, a solenoid centered in the casing in axial alinement therewith, a core in the solenoid, a diaphragm in the casing at the end of the solenoid opposite the opening in the casing, a screw for regulating the diaphragm, and a screw for adjusting the core, the latter screw being tapped through the former.

1,001,251. TROLLEY-POLE. James Coan, Westville, Ill., assignor of one-half to Charles F. Cook, Danville, Ill. Filed Nov. 13, 1909. Relates to the construction of the base which includes a pneumatic mechanism for raising and lowering the pole.

1,001,271. MACHINE FOR ELECTRICALLY WELDING CHAIN-

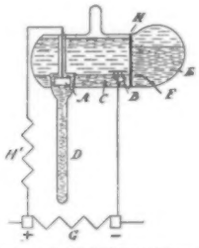
LINKS. Carlton L. Hoff, York, Pa., assignor to Standard Chain Co., York, Pa. Filed Oct. 4, 1909 Combined with the welding electrodes movable toward and from each other to grasp the link and apply the heating current is a fixed guide in front of the electrode and a movable positioning former in rear of the electrodes between which guide and former the link is positioned, and means for withdrawing the movable former during the heating of the link.

1,001,313. ELECTROMAGNETIC SWITCH. Harry W. Sheehy, Akron, O. Original application filed May 25, 1910. Divided and this application filed Aug. 31, 1910. The solenoid, acting against a coiled spring operates the switch.

1,001,330. ELECTRICAL PULL SOCKET. David P. Wolhaupter, Washington, D. C. Filed Jan. 28, 1911. Comprises a chambered body, a switch arranged within the chamber of the body, metallic operating means including a pull chain, and an insulator interposed between the operating means and a switch, and arranged to cover the latter in its chamber.

1,001,337. MINE-CAGE SIGNAL. Lee Bayer, Willisville, Ill. Filed June 6, 1910. A slidable plunger situated in the mine cage, and connecting with the track is used to transmit the signals.

1,001,358. TRAIN-LIGHTING SYSTEM. John Peachey Crouch, Newton Heath, and James Etchells, Moston, Manchester, England. Filed Nov. 27, 1909. Comprises a reversible dynamo, a battery, and a consumption circuit alternatively supplied from such dynamo and battery, a main switch corresponding to each direction of rotation of the dynamo having series and shunt operating windings, and means responsive to reversal of rotation of the dynamo for bringing one shunt winding into circuit for one direction of rotation of the dynamo and the other for the opposite direction of rotation.



1,001,589.—ELECTROLYTIC CELL.

1,001,363 and 1,000,364. SPARK PLUG. James M. Dayton, Torrington, Conn., assignor to Progressive Manufacturing Co., Torrington, Conn. Filed Nov. 14, 1910. A form of spark plug in which the terminal clip is help in place by a spiral spring.

1,001,365. SPARK PLUG. James M. Dayton, Torrington, Conn., assignor to Progressive Manufacturing Co., Torrington, Conn. Filed Dec. 30, 1910. A modification of the preceding patents.

1,001,400. ELECTROCUTING TRAP. Harry Hertzberg, New York, Abbot A. Low, Horseshoe, and Maurice J. Wohl, New York, N. Y., assignors to Abbot A. Low, Maurice J. Wohl, and Harry Hertzberg, trustees. Filed Aug. 10, 1909. The circuit is closed when bait is taken. An induction coil administers a shock to the animal taking the bait, the same circuit breaker closing the circuit of the induction coil and that of a small motor. A revolution of the motor automatically resets the trap.

1,001,406. APPARATUS FOR GENERATING ELECTRICITY BY CHEMICAL MEANS. Richard N. Hudson and Edward C. Brice, Lexington, Ky. Filed Oct. 28, 1909. Comprises an outer vitreous jar, a porous cup with a thick bottom, a carbon cup located in the porous cup, a thin porous cup located in the carbon cup, an alloyed tie member suspended in the thin porous cup, a closely fitting cover seated in the top of the thin porous cup, an alloyed pencil mounted on said tie member, and means for connecting electrical conductors with the pencil and the carbon cup respectively.

1,001,409. AUTOMATIC STOP MECHANISM FOR POWER-DRIVEN MACHINERY. Emerson P. Jennings, Jr., New York, N. Y., assignor to Cartwright Automatic Press Co., Springfield, O. Filed Sept. 1, 1909. Renewed July 14, 1911. Comprises an electromagnet and a circuit-breaker and closer arranged in the circuit of the electro-magnet and operatively connected to and positively actuated by the counting mechanism, whereby, when the counting mechanism registers a predetermined number, the electromagnet will be energized.

1,001,449. METHOD OR PROCESS OF AND APPARATUS FOR EXTRACTING METALS FROM THE ORES THEREOF. James Hart Robertson, New York, N. Y., assignor to Universal Ore Reduction Co., Phoenix, Ariz. Filed Oct. 12, 1910. Consists in causing a liquid solution containing a powder of the ore to be simultaneously subjected to the agitating effect of steam and an electrolytic effect due to the movement of the solution between short-circuited conducting elements or plates immersed in the solution.

1,001,453. ARC LAMP. Waldemar Ruhling, Berlin, Germany. Filed April 19, 1911. An insulating barrier separating the electrodes contains malachite and carbon, whereby upon the extinction of the arc there is formed between the electrodes a conducting bridge adapted to be consumed and thus to automatically start the arc upon the current being again switched into the lamp.

1,001,454. GAS GENERATOR. Charles Fremont Rukes, Kansas City, Mo. Filed Jan. 16, 1911. A hopper holding carbide is jarred by a small hammer operated by electromagnets, causing the carbide to fall into water. The electric circuit is closed and opened by a diaphragm on top of the tank, which diaphragm is affected by the tank pressure.

1,001,466. PROCESS OF EXTRACTING METAL FROM SOLUTIONS. Elmer E. Slaughter, Clifton, Ariz., assignor to William L. Austin, Riverside, Cal. Filed Jan. 6, 1908. Consists in subjecting a weak copper solution to the action of iron and another electric conductor submerged in the solution, whereby the copper is precipitated.

1,001,558. ELECTRIC TERMINAL CONTACT. William Edwin Russell, Danbury, Conn. Filed Jan. 31, 1911. The post is perforated lengthwise to receive a wire which is clamped in by the contact cap.

1,001,562. ELECTRICALLY CONTROLLED WEIGHING DEVICE. Walter S. Smith, Columbus, O., assignor to Columbus Electric Scale Co., Columbus, O. Filed June 27, 1910. An electrical device consisting of a number of magnetic contacts is controlled by the weight of the material discharged from the hopper and the speed of delivery of material discharged from the hopper gradually diminishes as the amount of material on the scales approaches a predetermined weight.

1,001,584. LAMP. William H. Gardiner, New York, N. Y. Original applications filed Oct. 15, 1909, and April 11, 1910. Divided and this application filed April 27, 1910. Combines a lamp-body having a globe-seat, a globe, and a clutch or grapple mounted on the body and composed of a plurality of members which close inwardly and upwardly upon the globe to hold it against its seat, and means for conjointly operating the members.

1,001,589. ELECTROLYTIC CELL. Henry Stafford Hatfield, Hove, England. Filed Oct. 12, 1907. Consists of an electrolyte in which any insulating substance deposited by the passage of the current through the cell is soluble and with which it is saturated; two electrodes on one of which the insulating substance is deposited and at the other of which the electrolyte becomes unsaturated with respect to the substance deposited without permanent alteration of the electrolyte; a supply of the insulating substance deposited resaturating by contact therewith the liquid which has become unsaturated; and a device for causing the circulation of the electrolyte with reference to the resaturating substance.

1,001,593. MARINE COMPASS. Harry Hertzberg, Brooklyn, N. Y., assignor to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Original application filed Aug. 14, 1906. Divided and this application filed May 31, 1907. Renewed Dec. 16, 1909. Vanes are mounted on the compass staff in such a way as to prevent sudden variations.

PATENTS THAT HAVE EXPIRED

Following is a list of the electrical patents (issued by the United States Patent Office) that expired August 28:

525,000. ELECTRICALLY OPERATED WIND VANE. Lynde Bradley, Milwaukee, Wis.

525,018. STORAGE BATTERY. Henry K. Hess, Syracuse, N. Y.

525,020. ELECTRICAL FIRE-ALARM APPARATUS. Ernst W. Jungner, Stockholm, Sweden.

525,034. ELECTRIC-ARC LAMP. Elihu Thomson, Lynn, Mass.

525,035. ELECTRIC-ARC LAMP. Elihu Thomson, Swampscott, Mass.

525,056. CASH REGISTER AND INDICATOR WITH ELECTRIC ALARM ATTACHMENT. Joseph B. Nesbit, Sunbury, Pa.

525,092. FLUID-OPERATED ELECTRIC SWITCH. Jean J. P. Clariot, Paris, France.

525,108. ELECTRIC MOTOR. Abraham V. Meserole, New York, N. Y.

525,118. MEANS FOR MOUNTING AND DRIVING DYNAMO-ELECTRIC MACHINES. Andrew L. Riker, New York, N. Y.

525,134. CIRCUIT-BREAKER. Cummings C. Chesney, Pittsfield, Mass.

525,169. ELECTRIC BELL. Richard Varley, Jr., Englewood, N. J.

525,233. SAFETY FENDER FOR TRAM, ELECTRIC OR CABLE CARS. Henry S. Robbins, Philadelphia, Pa.

525,277. ELECTRIC TIME SIGNAL FOR RAILWAYS. Robert D. Patterson, Lawrence, Mass.

525,290. ELECTRICAL RAILROAD SIGNAL. William F. Seymour, Mansfield, O.

525,291. ELECTRIC ALARM CLOCK. John Slater, Hutchins, Pa.

525,293. INCANDESCENT ELECTRIC LAMP CUT-OUT. Walter F. Smith, Philadelphia, Pa.

525,315. ROSETTE FOR ELECTRIC-LIGHT WIRES. David J. Cartwright, Boston, Mass.